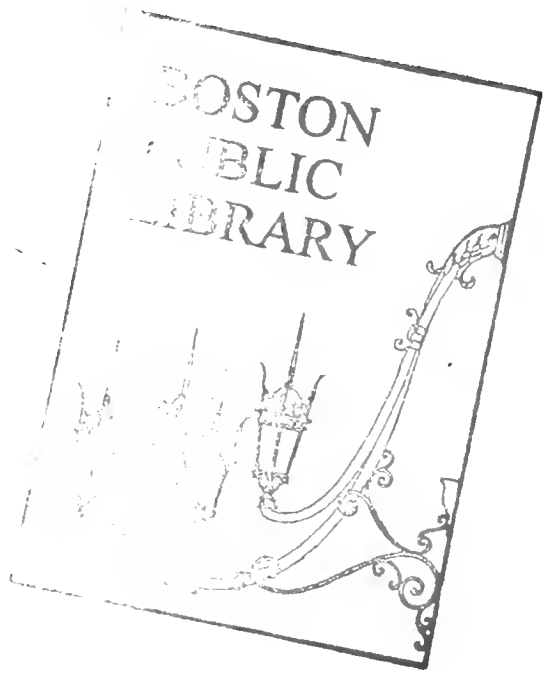
Central Boston Development Guidelines

BACKGROUND REPORT



BOSTON REDEVELOPMENT AUTHORITY
Robert J. Ryan/ Director

MAY 1983

CENTRAL BOSTON DEVELOPMENT GUIDELINES

BACKGROUND REPORT

BOSTON REDEVELOPMENT AUTHORITY

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A DEVELOPMENT STRATEGY FOR CENTRAL BOSTON
BACKGROUND REPORT

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INTRODUCTION

In 1980 more dollars were invested on a per capita basis for urban development in Boston than in any other city in the country. New construction has begun since then, and the building boom is expected to continue throughout the next decade. This urban growth -- an economic resurgence encompassing office, hotel, commercial, and residential development -- symbolizes a strong local economy with a growing job base and relatively low unemployment. In contrast to the declining national economy, Boston's renaissance is especially significant.

But changes of the magnitude Boston is experiencing are not unique. In the nineteenth and twentieth centuries, cities have undergone dramatic transformations. The evolution from agricultural trade, to manufacturing, to service-based economies has altered the complex relationships of social, economic, and environmental factors which shape cities everywhere. A city in the 1920s scarcely resembled that of a century earlier.

Similarly, new trends and shifts in Boston's economy in the 1980s and 1990s will affect the City's form and function. One of the most important challenges facing the City today is to influence the economic and physical changes so that the greatest possible benefits accrue to residents of the City and the region, and so that Boston's unique physical characteristics are recognized and enhanced.

As the public agency responsible for the physical planning and development of the City, the Boston Redevelopment Authority has initiated a study to examine the effects of recent development, assess projections for future growth, and establish policies to guide the City's development over the next decade. The study will focus on the central part of Boston (see following map). Parts of the City beyond the study area boundaries fall within the planning jurisdiction of Boston's Neighborhood Development and Employment Agency.

The BRA study, "A Development Strategy for Central Boston", will consist of two phases. This document is the first phase. It presents background information on recent development in Central Boston, projections for future growth, and issues to consider in formulating development guidelines:

Development

- Commercial
- Institutional
- Residential

Design

Environmental

- Impacts of development
- Energy
- Infrastructure

Comprehensive Background Information

Employment
Physical Inventory
Fiscal and Property Profile

The second phase of the "Development Strategy" will result in a set of development guidelines, representing BRA policy for growth in Central Boston during the next decade. Reflecting sections of this report, the guidelines will address the four major categories: commercial development, residential development, design, and environmental quality. The BRA will prepare a preliminary draft of policies which will be available for public review.

Because guiding the development of Central Boston is a significant process, the BRA encourages interested individuals to contribute their ideas and insights. Opportunities for public review and participation will be presented as various policy options are considered.

Complementary studies are currently underway, such as the Chamber of Commerce "Boston 2000" and "Goals for Boston" projects. In addition to this Development Strategy project, the BRA is conducting a study to assess the capacity of the City to absorb new development. A third BRA study, "the Downtown Crossing Report", was recently completed and provides planning strategies for the Downtown retail area. Input from all these complementary projects will enhance the effectiveness of development strategies for the future.

DEVELOPMENT

Office
Retail
Manufacturing
Visitor-Related Facilities
Institutional

OFFICE DEVELOPMENT

INTRODUCTION

The office sector[1] has assumed a leading role in the creation of new employment in Boston during the past twenty years, and the expansion of the office sector has fostered much of the City's recent development activity, as recent statistics indicate. Office employment Downtown[2] has risen by more than fifty percent since 1960, and its growth has helped to maintain the local economy in a period when employment in manufacturing and trade declined. The City's total employment today is just slightly above the 1960 level. The office sector now accounts for over fifty percent of Boston's total job base both Downtown and City-wide. Office space Downtown, which now accounts for two-thirds of all office space in the metropolitan area[3], has expanded substantially. Since 1975, approximately 1.75 million square feet of space was added.

Comparisons with other cities illustrate the dominance of the office industries within Boston's economy. While Boston is twentieth in population size in the country, it is the fifth largest in the nation in terms of office space, ahead of such cities as Houston, San Francisco, Atlanta and Philadelphia. Only New York, Chicago and Washington, D.C. have more office space. With over one thousand financial firms located in the City, Boston serves as a national center for finance, second only to New York.

Indicative of the office sector's strength, the office market outlook through the late 1980's is excellent. The office space surplus of 1976-1978 has disappeared. 1979 through 1981 was a period of extreme shortage, accompanied by a rise in rents and even a loss of existing firms from the City to the suburbs. Currently, the vacancy rate in Class A structures is 1.7 percent. Low vacancy rates have led to a significant levels of new construction and rehabilitation activity. While vacancy rates may rise slightly over the coming two years, a strong market for new construction and rehabilitation is expected to continue.

This section presents an overview of the role of office industries in Central Boston today, analyzes recent activities in office development, and presents a projection for office development over the next decade.

CURRENT STATUS OF BOSTON'S OFFICE SECTOR

Downtown Office Development

The resurgence of the City's economy and the growth of services was made most visible by the boom in new office construction since 1960. The downtown private office stock increased by over sixty-five percent, from approximately twenty-two million square feet in 1960, to approximately thirty-nine million square feet by the end of 1982.

The City's Federally-funded Urban Renewal program, in concert with dramatic employment growth in the finance and business sectors of the local economy, fueled much of this new development. But even with the absence of Urban Renewal funds, construction of office space has continued. Between 1976 and the present, approximately 1.75 million square feet of office space has been

completed. (Table I-1 outlines the projects completed between 1975 and 1982). Today over fifty percent of the total commercial space and development Downtown are devoted to offices, and this percentage is projected to increase over the next decade.

Construction activity lagged behind the extraordinary growth in employment in Boston in the period. As the economy improved and as vacancy rates declined, local office developers turned to the rehabilitation of structures to quickly bring additional space on line. Since 1976, 4.5 million square feet of office space has been upgraded to Class A quality.

The rehabilitation of older office space, which has been in evidence since the early 1970s, should continue at lesser pace into the 1980s, as the pool of older office space available and suitable for upgrading diminishes. The scarcity of land Downtown for new construction, the special protection given buildings of architectural significance which discourages demolition, and the shorter lead time for rehabilitation and conversion projects had made rehabilitation a competitive alternative for the development community, as the wave of new office space completions began to come on stream.

At present, more than four million square feet of private new office space and 1.6 million square feet of rehabilitated Class A space is under construction and scheduled for completion over the next three years. In addition, another three million square feet of office construction is in the planning stage for 1987 and 1989 completions.

The majority of the office space constructed prior to 1976 was in buildings sponsored by major financial institutions. Speculative office construction, which was limited to the moderate and smaller-sized developments, accounted for only twenty percent of total office space between 1965 and 1975. Since 1976, most of office space to come on line, and virtually all of the major developments presently under construction or proposed, are speculative.

The growth in office space in the Downtown runs counter to trends seen in other large metropolitan areas where the suburbanization of office development has been a significant factor. In Boston, the downtown area has retained the majority of the metropolitan area's office stock. Approximately two-thirds of all office space in the region is located in Central Boston. The City also has captured a significant share of new office construction in the region; from 1971-1975, Central Boston captured seventy-two percent of the thirteen million square feet of new office space built in the region. Since 1976 the capture rate has been approximately sixty percent. Moreover, this office market has consistently had lower vacancy rates than the suburban market.

Current Office Space Supply

The analysis of Central Boston's office space supply is based on an inventory of four district areas, delineated on Map ___. The office space inventory encompasses the Government Center, Financial District, Midtown, and Back Bay. Space in these areas can be classified into four types: Class A - built or substantially renovated since 1960; Class B - older space that has had major renovations and is competitive with new space; Class C - older space with some modernization and upgrading; and Class D - older space with little or no improvement. An office industry study[4] noted that in 1982 Boston's

first class office buildings were renting at an average of twenty-nine dollars per square foot, in a range from 23.50 dollars to forty dollars, and that the newest office space is renting at an average of thirty-two dollars, in a range of twenty-seven dollars to forty dollars per square foot.

Class A space accounts for approximately forty-one percent (15.7 million square feet) of the current office market; Class B space accounts for fifteen percent (5.8 million square feet); Class C space accounts for forty-two percent (15.9 million square feet); and Class D space accounts for two percent (715,000 square feet).

The Financial District has the largest concentration of private office space with twenty-one million gross square feet (fifty-five percent of total stock). Office space constructed in this district accounted for over sixty percent of the new office development in Boston between 1960 and 1982.

The Back Bay is the second largest market area, but significantly smaller than the Financial District, with eight million gross square feet of office space. Twenty-five percent of the City's office space built between 1960 and 1982, was constructed in Back Bay--one of Boston's Urban Renewal areas.

The remaining two office centers, the Government Center and Midtown areas, have smaller concentrations of competitive office space with 4.8 and 4.4 million gross feet, respectively. These two areas differ in their characteristics. In Government Center, as its name implies, new public office space predominates, and the Midtown area is comprised mostly of private, unrenovated, older space.

During the past five years, the majority of new Class A office construction or rehabilitation activities has been concentrated in the Financial District. This district continues to be the high demand area for financial and business services firms. Almost all of the new office development currently proposed or underway is located in the Financial District and immediately adjacent areas.

Office Employment

Today, over 297,000 workers are employed in Downtown. Almost half of these people, 154,000, work in the office sector.

Boston's office industries have generated almost all of Downtown's employment growth during the past fifteen years. Between 1966 and 1982, employment in the office sector grew from 106,000, to 154,000 jobs.[5] The major growth industries Downtown have been business and professional services; and finance, insurance, and real estate.

Most office sector jobs are concentrated in professional and clerical positions. In 1980, clerical jobs numbered approximately 61,000 (forty percent of total private Downtown office workers). Professional workers (engineers, accountants, lawyers, printers, etc.) filled 56,000 jobs, accounting for thirty-eight percent of the total workforce.

In 1982, Boston residents held twenty-six percent of the total number of jobs in the private office sector Downtown. This is in contrast to their capture rate of forty percent of all jobs city-wide. Residents of the City, however,

have been capturing an increasingly larger share of the higher paid professional jobs. Between 1960 and 1982, the number of professional jobs held by residents increased from 12.5 percent to twenty percent of total City resident employment, partly a result of the changing demographic profile of residents. Boston residents, however, still comprise a higher percentage of non-professional office workers than their suburban counterparts.[6]

Current Demand for Office Space

The current demand for office space results from the creation, expansion, and migration of companies and is reflected in vacancy and absorption rates.

- Office Industry Expansion and Migration

  Expansion of existing firms has accounted for approximately sixty-three percent of recent demand for new office space, while new companies forming in Boston accounted for twenty-four percent of total demand (mostly within Class C buildings which provide smaller and less expensive space).[4] Firms occupying more square footage per employee, a recent trend in office space use, may account for the remaining demand. (Such firms are expanding in their space needs, not necessarily in total employment levels.) In-migration of firms to the City played a small role in the private office market, accounting for only thirteen percent of total demand. Such firms have tended to be small (average size of nineteen employees), but more recently these new firms have been larger than in the past. These firms, primarily finance/insurance/real estate and professional service, preferred Class A and B office space. They moved to Central Boston to improve access to clients and support services, or to upgrade company image. They locate primarily in the Financial District, the center for New England banking and an area recognized for its concentration of finance and service firms.

- Vacancy Levels

  Vacancy levels measure the relationship between supply and demand and basically indicate how the office market is operating. Vacancy levels in urban office space can influence the expansion of existing firms, the establishment of new offices, and the movement of firms between cities. High vacancy rates often discourage new development, as well as the maintenance of older structures. Alternatively, they may lead to the conversion of marginal office structures to residential and other non-office uses. Low vacancy rates, as the current office economy now demonstrates, encourage new development and the conversion or upgrading of marginal structures into higher rent space. Prior to the supply of new space, expanding firms are forced to either delay growth or seek space outside of the City. As rents rise across the board due to the tight market, some less profitable firms may leave their urban locations for less expensive space elsewhere. A minimum vacancy rate assumed to allow the market to operate normally, is generally thought to be about five percent.

  Currently Boston has one of the lowest office vacancy rates of any major U.S. city. Vacancies in the Downtown are approximately 1.7 percent for Class A office space and 3.6 percent overall for all classes. According

to a 1982 survey, the Class A vacancy rate was similar to those found in Los Angeles and Washington, D.C, while Atlanta, Denver and Fort Worth each had Class A vacancies of over ten percent.

From 1963 to 1970, when the national economy was growing and Central Boston's employment expanding rapidly, office vacancy rates decreased significantly from seven percent in 1960, to two percent by 1970. During this same period, over five million square feet of new space was added to the Downtown office stock.

Since 1970, a combination of accelerated office space development, continued expansion of the service sector, and two major national recessions have caused significant fluctuation in the vacancy rate, as Table I-2 indicates. The vacancy rate peaked in 1977 at fourteen percent because 6.5 million square feet of office space in 1975 and 1976 and because national recessions of the early 1970s increased unemployment in Boston.

- Absorption Rates

The annual absorption rate provides an indicator of the level of demand at a point in time and records how fast new space is being occupied. It also is used to evaluate whether the amount of new space in the pipeline responds to the short-term needs of the market.

Absorption rates are a measure of the square footage demand for office space in any given year. Interpretations vary depending on whether a rate refers to a past situation or the future. Referring to the past, absorption rates measure the amount of new office space occupied over a given time. Limited space availability can thus lead to an absorption rate which underrepresents total demand. Absorption rates which apply to a future situation represent projections of demand based upon net job growth, replacement of demolished space, and changes in office space requirements.

During the past five years, the Downtown office market had an average annual absorption rate of over 900,000 square feet per year. In comparison, the average annual absorption rate from 1971 to 1975 was over 1.2 million square feet, primarily due to the large amount of office space that came on line in 1975. In 1982, one million square feet of office space was absorbed (Table I-3).

FUTURE GROWTH OF BOSTON'S OFFICE INDUSTRY

Boston's office sector will continue to expand throughout the 1980s. The additional employment created by this growth, the continuing attraction of Boston as a location for office businesses, and the changing characteristics of office space use will all generate future demand. According to BRA projections, between ten and thirteen million gross square feet of additional office space will be needed by 1992. As well, some of the older office space will require upgrading or replacement (Tables I-4 and I-5).

Some of that demand will be met by the over five million square feet of new or rehabilitated space scheduled for completion by the end of 1986. This new development compares favorably to office growth in other major U.S. cities.

Houston, which has a similar size office market, reportedly has eight million square feet of office space under construction. Chicago, with a much larger office space base, will also add eight million square feet to its downtown's ninety million square feet of space within the next two to three years. New York City is expected to add approximately seven million square feet of new office space in the next few years.

The space added to Boston's office stock has helped to even out the market and should continue to do so in the next decade. Between 1979 and 1981, office space was in short supply, causing rents to increase and causing some of the City's office tenants to relocate in the suburbs. In contrast, the market between now and 1986 should normalize with the steady addition of new space, a normal availability of 1.1 million square feet per year (five to six percent vacancies), and continuing strong demand (Table I-6).

Several national and local trends lie behind forecasts for the growth of Boston's office space. First, many of Boston's office businesses are in sectors which are experiencing growth nationwide. Banking, insurance and investment services, business management, administrative, and consulting services, as well as accounting, engineering, legal, medical, educational and other professional services are examples of such industries. Based on trends in the U.S. economy, at least seventy-five percent of the Downtown's employment growth during the next decade will be in the services, finance, and communications sectors, as is outlined in Table I-7. Office employment Downtown is projected to reach 191,000 jobs by 1992, an increase of 38,000 jobs.

Second, Boston has become an attractive location for the office industries. Several factors account for this: it is the hub of a region growing in employment and population; Boston is a national center for education, medicine, and other professional services; it supports an international airport and offers retail and cultural attractions. Other factors include the on-going public and private investment in the Central Boston, the rising competitive advantage of a downtown location in terms of energy costs, and the unabated interest expressed by potential renters and builders. In combination, these factors should help to maintain a significant level of demand for office development.

Third, the composition of office space stock, the distribution of employment within office space, and the average size of occupied space, have been changing in Boston during the last two decades. In 1970, due to the limited building that occurred in the 1960s, only twenty percent of the stock was Class A, twenty percent Class B, and sixty percent Class C. By 1982 the distribution changed to forty-three percent, sixteen percent, and forty-one percent for A, B, and C, respectively.

Another feature of office use that has been changing over time is the amount of office space occupied per employees (Table I-8). Both in Boston and the U.S., the amount of space per worker has been gradually rising. This is due to several factors: new buildings generally provide larger quarters; many firms are moving upward and expanding; older buildings, which tend to be more crowded, are becoming obsolete; and some older buildings which are more spacious, have been put to use for office storage space for cost reasons.

In Boston, the average gross square feet to employee ratio rose from 209 in 1966 to 240 in 1982, for many of the above reasons. Expressed as net rentable square feet per employee, the rise from 1976 to 1982 is from 182 to 192. According to a BOMA (Building Owners and Manager's Association) international survey of office buildings, the U.S. average of net rentable square feet to employee increased from 187.1 in 1975 to 1970 in 1979. Thus, both local and national use reflects the trend toward increasing office space requirements.

In concert, employment growth, the desirability of Boston as a business location, and the changing characteristics of office space use will generate future demand for additional office space with Boston. Using the projections of employment and office space use, it is possible to get a detailed picture of the demand for office space by class (Table I-4). Given the present square foot use of space per employee and number of new employees, total new 1982-1992 demand for Class A office space would be about ten to twelve million gross square feet. Based upon recent leasing activity, almost twenty-five percent of employment growth would be due to new firms and in-migrants, with seventy-five percent originating from expansions of existing firms. The expanding firms would, in general, demand Class A space, and the new firms are expected to demand Class B and C space. A demand for an additional two million square feet of Class B space and 1.5 million square feet of Class C space is projected.

Six
Five million square feet of the demand for additional office space is likely to be met from between 1983 and 1986 and up to seven million between 1986 and 1992. Demand during the first period is due in part to pent-up demand from prior years and greater employment growth. The demand during the late 1980s will arise from the steady increase in office employment. The potential future demand would most likely be met by a combination of new, rehabilitated, or converted office space.

DEVELOPMENT ISSUES

The projections for continued growth in the office sector bodes well for other sectors of Central Boston's economy and for the City as a whole. Business visitors are a major component of the City's expanding hotel sector and likewise, office workers are a major component of Central Boston's captive retail market. Their increasing numbers in recent years has helped to reverse the decline in retail sales and to fill new hotel rooms.

While office sector growth has bolstered other local businesses and helped to generate new jobs, it has also benefited the City's fiscal profile. Office buildings contribute substantially to the local property tax base, paying a higher rate per square foot than any other use. This has helped to reduce the property tax for residential owners.

The location of new office projects can support the City's efforts to redevelop underutilized areas, such as portions of Washington Street, North and South Stations, and some places in the Financial District. With the reductions in Federal funds and the budget limitations imposed by Proposition 2½, the City will rely even more on office developers to provide public improvements formerly undertaken by the City to revitalize such areas.

Despite the current and potential benefits of the office boom, the growth is not without its adverse impacts. Some of these are outlined in the Environmental Quality and Design sections of this report and include excessive levels of wind and noise, shadows cast by tall buildings, and degradation of air and water quality, as well as issues of urban form.

Because the market for office space is strong, office developers typically can outbid other existing or potential users of downtown property. As a consequence, there is pressure to demolish existing older buildings, which threatens the City's architectural heritage. There is pressure on manufacturers to relocate, which threatens peoples' jobs and the diversity of the local economy. An there is pressure on the residential stock, occasionally through demolition but primarily through the inability for residential developers to compete for space.

The amount, timing, forms, and location of office development requires careful management by the City. Through the use of development guidelines, the City can help to maintain the current stability of the office market (as evidenced by the vacancy rates in Table I-2), and to maximize the potential benefits of office development to Boston.

NOTES

1. The office industries are Finance, Insurance and Real Estate (FI Transportation, Communications and Public Utilities (TCPU), and Professional and Business Services.

2. When statistical information is used in reference to "Downtown", includes data collected from the Central Business District and Ba

3. Between 1930 and 1960, only three million square feet of addition space was built in the Downtown, and most of it was housed in c building, the John Hancock Insurance Company's home office on Street. This construction slowdown was brought on by the Depr and World War II. Subsequently, Post War suburbanization and way construction which encouraged the move of both commerce ar industry to the suburbs, further discouraged new investment in and led to significant deterioration. New development followed af commencement of the City's of Urban Renewal program.

4. Office Network, Inc., "National Office Market Report".

5. Downtown office employment growth has not been consistent throu this period. Large increases in office employment occurred betwe 1969-1972 (17,000 new jobs) and 1976-1980 (11,000 new jobs). Be 1972-1976, however, only 8,000 new jobs were created in the offic industries.

6. This correlation is very strong within each of the occupation cate with the exception of offices for manufacturing, trade, and busin service firms.

7. Office Network, Inc.

8. From unpublished BRA report, Boston Office Industry: A Long-T Perspective (currently in draft).

OFFICE TABLES

RETAIL

INTRODUCTION

Boston, the hub of the metropolitan area, historically has served as a major regional retail center, attracting people who live and work in the City, as well as those from the suburbs. Today the City, and Central Boston especially, remains the foremost shopping area in the region, though retail activity suffered between 1948 and 1977 from national demographic trends and economic fluctuations. Growth in other commercial sectors; an increase in residents Downtown and higher per capital incomes of those residents; and new marketing strategies have helped to boost retail sales after several decades of decline. For the next decade, prospects for retail trade look even brighter, based on growth forecasts for employment, tourism, and residential development in some Downtown neighborhoods.[1]

Promoting retail growth is an important component of the City's development strategies because of the significant contribution retail activity makes to economic and social vitality of Boston. The retail sector serves a major role in supporting and stimulating other commercial and residential uses; it creates jobs for Boston residents; and it increases property values and City tax revenues. Targeting the location of new retail activity, the City can more effectively implement its efforts to revitalize some areas of Central Boston, the center of retail activity.

To capitalize on the potential benefits of retail growth and to help provide safe, convenient, and suitable shopping facilities for residents and visitors, the City needs to continue to implement existing development strategies and design new ones which could help to accomplish the following goals:

- o increase retail activity in Central Boston;
- o maintain and expand the variety of products and prices, as well as the distinctive nature and appeal, of Central Boston's three major retail centers--Downtown Crossing, Back Bay, and Quincy Market;
- o improve the vitality and attractiveness of some shopping districts;
- o improve accessibility to and amongst the districts.

This chapter provides information on the present characteristics of retail trade in Central Boston and forecasts trends for the future. (Central Boston includes Back Bay and the Central Business District, the two areas used by the U.S. Census of Retail Trade to describe retail trade in Boston which most closely approximate the study area.) Outlining the issues related to retail development that face the City today, as well as strategies successfully employed to deal with them in recent years, the information should help in formulating development policies to guide future retail growth.

CHARACTERISTICS OF RETAIL ACTIVITY

The Boston metropolitan area, with sales totaling nine billion dollars, is the major retail center in New England. The City itself is the center for retail trade. Its sales accounted for nearly two billion dollars in 1977, the latest year for which such data is currently available.[3]

Between 1948 and 1977, retail trade in the City declined as the population increased in the suburbs. Central Boston's major retail district's share of the total Statistical Metropolitan Area's (SMSA) retail sales dropped from twenty percent to 6.5 percent. This population shift, predominantly an exodus of middle- and upper-income groups, caused the City's retail market to shrink in terms of relative affluence, as well as size. While the median family income for the SMSA increased by nearly ninety percent, that of Boston's residents increased by less than forty percent between 1949 and 1978.[4] Suburban retail space grew to meet the increased demand in outlying areas. (Table II-1 shows the 1958-1979 trends in retail sales for the SMSA, the City, and the Downtown.)

Despite this metropolitan shift (a pattern seen nationwide) and a decline in retail sales, Boston has remained the major regional retail center. Central Boston has approximately 4.3 million square feet of gross leasable retail area, including that occupied by retail stores, eating establishments, and cinemas. This exceeds the amount found in any other area of the region and is twice the scale of the largest suburban grouping--the combination of the North Shore Shopping Center and Liberty Tree Mall.[5]

The character of retail activity in Central Boston and its role as a regional center is more clearly indicated when the composition of Central Boston's retailing is compared to that of the metropolitan area as a whole. Currently, approximately twenty percent of all comparison goods sales in the Standard Metropolitan Statistical Area (SMSA) are made in Central Boston. Comparison goods include apparel, general merchandise, furniture and home furnishings, and miscellaneous goods. In 1977 Central Boston's regional share of restaurant sales was well over ten percent.[2] That figure predates the opening of Quincy Market, which derives over half its sales from restaurant business. Restaurant activity is becoming an increasingly important component of Central Boston's retail sector.

Recent trends have led to increased sales, and the City is likely to continue as the major regional retail center. The long-term trends of suburban economic and population growth have stabilized, dampening the rate of growth in retail sales in the suburban areas of the SMSA between 1972 and 1977. Also, Boston's captive market--its workers, visitors, and residents--has grown, compensating for the loss of traditional markets. The number of office workers has increased by over fifty percent; that dramatic gain has fueled much of the retail growth. As well, affluent young residents have moved into housing in neighborhoods downtown, such as Back Bay, Beacon Hill, the South End, and in new housing on the Waterfront. Between 1970 and 1980, the population increased ten percent and per capita income grew by five percent in these areas.

The growth of captive markets concurrent with the decline of the traditional trade has led to adjustments in Central Boston's retail sector, especially in its dominant retail district -- Downtown Crossing. Such adjustments take time however, and the lag between old and new retail strategies may have contributed to declining sales during the 1975-1976 recession. Though sales have increased since 1977, adjustment of the product mix, marketing techniques, and location of retail activity in Central Boston is ongoing. The adjustment process has varied with each of Central Boston's major shopping areas, as described below.

o Downtown Crossing

Retail trade in Boston traditionally has been concentrated along Washington Street and its vicinity, an area now known as Downtown Crossing. Since well before World War II, the mix of products and merchandising techniques were firmly established to meet the needs of the area's traditional middle-income market. The shift of population to the suburbs and competition from suburban shopping centers seriously eroded Washington Street's retail sales. Stores which did not adapt their product mix or merchandising techniques to attract new markets, went out of business. In some cases, this area-specific management problem was exacerbated by mismanagement or financial problems chain-wide. In others, changes in Boston's retail trade simply reflected national trends: the growing popularity of specialty shops and festival marketplaces, and the increasing dominance of chain stores over independents. Between 1972 and 1979, major department stores or large dry goods stores -- Raymond's, Gilchrist's, Stearns, Kennedy's, Conrad Chandler, and R.H. White's--closed their doors, as did many smaller shops.

Recent changes have improved retail sales in the area. In 1978 vehicular traffic was restricted along portions of Washington, Summer, and Winter Streets to form a pedestrian mall. A new name--Downtown Crossing--and such improvements as brick paving, historic-era lights, benches, and an arcade, gave a special identity to the area. As traffic volume decreased and pedestrian volume increased, the air quality and noise levels improved. Several large stores re-oriented their merchandising techniques, and specialty shops moved into some vacant buildings; both attract business from the growing number of Downtown employees. Between 1978 and 1980, retail sales for Downtown Crossing grew by twelve percent,[6] and the benefits extended to retail business on neighboring streets as well.

Today Downtown Crossing exceeds all other shopping centers in New England in square footage and retail sales.[7] There is nearly 1.75 million square feet of comparison goods selling space, one million of which is occupied by three general merchandise stores, and the remainder is distributed amongst more than three hundred other stores. In addition, restaurants and personal service-oriented retailers account for nearly a half-million square feet of space. The department stores -- two of which are flagship stores of their chains -- and major concentrations of jewelry, camera, and apparel stores act as the prime retail attractions. The district is also characterized by a wide variety of predominantly moderately-priced merchandise. Estimated 1982 sales for the comparison merchandise sector totalled 373 million dollars (well over two hundred dollars per square foot).[8] Nearly half those sales came from purchases by Downtown employees.[9] (Table II-2 indicates the changing nature of goods sold Downtown by indicating employment trends from 1972-1979).

Retail business in Downtown Crossing could increase by as much as sixty percent by 1990, according to "The Downtown Crossing Economic Strategy Plan", a recent study released by the BRA. Market support exists for an expansion of retail space of up to 400,000 square feet. Some expansion is already underway. When it opens in 1984, Lafayette Place, a

large mixed-use project now under construction, will house nearly two hundred shops, twenty-four restaurants and cafe's, a five hundred-room hotel, and eight hundred parking spaces for shoppers. The complex will add 250,000 square feet of space Downtown.

Forecasts for retail growth are based on demographic changes Downtown, on the anticipated office employment growth, and on projected increases in the number of tourists and business people visiting the City. The Downtown population increased by five percent between 1970 and 1980, and the per capita income of residents grew by eighteen percent. Trends of smaller household size and a greater number of households in neighborhoods near Downtown Crossing are likely to increase retail sales. The number of employees working Downtown is projected to grow by 15,000 by 1990; the number of tourists and business visitors by _____. Projected growth in all three sectors could greatly expand the captive market for retailers.

Achieving sixty percent growth in retail sales relies heavily on the presumption that the City and local businesses will implement the planning strategies outlined in "The Downtown Crossing Economic Strategy Plan". The strategies include land use guidelines, traffic and other physical improvements, and long-term management mechanisms.

o Back Bay

Retail sales in Back Bay diverged from trends found elsewhere in Boston between 1948 and 1977. While total retail sales and the numbers of employees and establishments declined city-wide, retail activity in Back Bay increased steadily. Between 1972 and 1977, sales rose four percent and increased by the same percentage between 1977 and 1979.[10] This trend is estimated to have continued with 1980 retail sales estimated at 164 million dollars. In contrast to the Washington Street retail area, Back Bay has had great success in capturing the new captive market and retaining much of its original market. Unlike Washington Street, which was oriented to the general needs of moderate-income suburban residents and older City shoppers, Back Bay always maintained its image as a place offering a high quality, prestige, cosmopolitan variety of merchandise. The shopping environment matched the merchandise, a combination that precluded competition from suburban malls. Back Bay's merchandise was better suited to the needs of the growing captive market and the specialized needs of some suburban shoppers, since it included high fashion apparel, art, and restaurants, as opposed to major appliances, furniture, and more traditional apparel. Back Bay had the further advantage of being somewhat more accessible by car than was Washington Street.

The Prudential Center, developed in 1965, substantially increased retailing in the area with the addition of two major apparel-oriented department stores and a mall of specialty shops. Today Back Bay remains the second largest retail center in Boston with 1.1 million square feet of retail space. When Copley Place is completed, shops in that large mixed-use project will add 300,000 square feet of retail space to the Back Bay shopping district. Neighboring developments, such as the State's Transportation Building, will increase the captive market when construction is finished.

- Quincy Market

Quincy Market, the newest of Central Boston's retail centers, illustrates the role retail activity can serve in revitalizing underutilized areas of the City. This development established the unique attraction of festival market-type retailing, now seen nationwide. This complex of specialty shops, novelty shops, restaurants, and small fast food establishments was developed between 1976 and 1978 from historic but decaying warehouses and Faneuil Hall. The environment was designed and is carefully controlled to establish an ambience attractive to tourists. The inclusion of pedestrian malls, scheduled outdoor entertainment, and strict area-wide management were relatively new marketing strategies to Boston and, in only a few years, have helped Quincy Market to become a strong regional retail and tourist attraction.

Quincy Market houses 150 shops[9] in 220,000 square feet of retail space. In 1982 total retail sales amounted to approximately eighty million dollars, well over three hundred dollars per square foot.

Quincy Market, like Downtown Crossing, should benefit from future growth in Downtown employment. Because of its attraction for tourists, the market's retail sales should expand with growth projected for that sector.

- Other Retail Areas

In addition to the three major retail districts other Central Boston retail clusters--Charles Street, the North End and Haymarket, the Waterfront, Chinatown and the Theater District--have district identifies and draw customers from beyond the districts' immediate neighborhood. Comparison, convenience, and service shops are scattered throughout the Financial district, where they serve the needs of office workers, and in other parts of Central Boston, where they accommodate residents of their immediate neighborhoods. (Table II-3 shows the distribution of retail space within the City and Central Boston, and Table II-4 outlines the distribution of consumer-oriented retail sales.)

DEVELOPMENT ISSUES

Guiding retail growth is important to the City physically, economically, and socially. As evidenced by Quincy Market and Downtown Crossing, retail improvements can upgrade the appearance and utility of open spaces and streets in commercial districts and can spur revitalization of key areas. Retail growth can draw more business from the regional market, provide additional jobs and tax revenue, and stimulate growth in other commercial sectors. When shops are easily accessible and provide a variety of goods in a range of prices, the retail sector can help to meet the needs of residents, workers, and visitors.

To maximize the benefits of retail growth, development policies should aim, first, to increase retail activity in Central Boston. The recent "Downtown Crossing Economic Strategy Plan" is a step in that direction, providing adequate market information to attract new retail investors. Central Boston has an advantage over regional retail competitors because of its distinctive archi-

tectural, historic, and cultural attractions, but those attractior been sufficiently marketed to regional shoppers. Better promo to increase retail activity from the regional market, as demonst success of Quincy Market and Back Bay.

A second aim of development policy is to maintain and expand t products and prices, as well as the distinctive nature and appe Downtown Crossing, Back Bay, and Quincy Market. The Back district and Quincy Market are both retail successes. It is imp ensure that the qualities which give them their special characte served. Large scale retail development that would broaden the and magnitude of these districts to a point at which it would di special character and diminish Downtown Crossing's primacy as retail district in Boston, should be discouraged.

Downtown Crossing requires special care, since it is the one re that suffered from a long-term decline. Its enhancement is clos goals for revitalizing adjoining blighted areas -- lower Washingt the adult entertainment zone. For these reasons, the implement "Downtown Crossing Economic Strategy Plan" is especially impor

A third aim of development policy is to improve the vitality and of some shopping districts so they contribute to the physical, a economic, improvement of the City. Small-scale changes--landsc located benches, signage, outdoor cafes--can give a clear identit and make it more habitable. The "Downtown Crossing Economic Plan" describes small-scale physical improvements that the City a could implement. Copley Square in Back Bay could be a hospita place for shoppers to relax or view outdoor entertainment, but it well-connected with the street, lacks trees and comfortable seatir was recently initiated by the BRA to determine what design chan the square a more vital open space.

In addition to small-scale changes, substantial retail projects can design of key areas of the City, especially when retail is include ment schemes for other commercial sectors. When planning new c of some magnitude, it is important locate retail establishments in will reinforce activity along streets.

A fourth aim is to improve the accessibility of retail areas. When safely and easily accessible and provide a variety of goods in a r prices, the retail sector can effectively meet the needs of shopper areas are currently perceived as unsafe. Major problems facing D Crossing are the close proximity of the adult entertainment distric underutilized areas of lower Washington Street, and the lack of ni activity.

Accessibility is a key factor in attracting shoppers and in facilitat activities. It could be improved for all three major districts. Dov shoppers depend on mass transit, and over sixty-five percent of f MBTA riders shop there.[14] However, those who do not use public less likely to shop Downtown (only twenty-six percent of non-rider there). To increase ridership and to improve the trip for current

important component of development policy would aim to incorporate new stations within planned development projects and upgrade existing ones. To attract auto-oriented shoppers, development policy should aim to improve vehicular accessibility without unduly burdening the circulation system and provide safe, convenient parking where it is most needed. Lafayette Place Garage, with approximately eight hundred spaces reserved for shoppers, represents an example of this.

NOTES

1. Frances Larson and Gregory Perkins, "Retail Trade in Boston: Yesterday, Today, and Tomorrow", Boston Redevelopment Authority, May 1981, p. 2.

2. United States Census of Retail Trade, 1977. This is the latest ediction available in 1983.

3. Ibid, p. 1.

4. United States Department of Commerce, "Census of Population and Housing", 1950 and 1970; and "Current Population Reports-Consumer Income", Series P-60, #118, 1979.

5. Skidmore, Owings and Merrill, draft of "Downtown Crossing Economic Strategy Plan", Boston Redevelopment Authority, May 1983, p. 12.

6. Ibid, p. 20.

7. Ibid, p. 2.

8. Ibid.

9. Ibid.

10. Larson and Perkins, p. 34.

11. Ibid.

12. Skidmore, Owings and Merrill, p. 28.

RETAIL TABLES

MANUFACTURING

INTRODUCTION

Over the past few decades, Boston has changed from a manufacturing center to a center for the service industry. Although manufacturing no longer dominates the City's economy, it retains an important role. The manufacturing industry provides jobs for ten percent of Boston's labor force, most often in proximity to employees' homes, where the firms also contribute to the health of the neighborhoods. Manufacturing helps to diversify the local economy. Exporting products, it draws new dollars into the City. Although manufacturing would not seem to be essential for Central Boston's economic health, its importance to the City-wide economy and the City's labor force makes it so, due to the synergistic relationship between the production of goods and services.

The vitality of Boston's manufacturing sector is indicated by its most recent performance. Since 1975, employment levels have remained relatively stable, reflecting the City's success in halting a twenty-five year decline.

The composition of Boston's manufacturing sectors has changed as new types of firms have expand. The City's strongest industries traditionally have been food products, apparel and leather, printing and publishing, fabricated metals, and non-electrical machinery. Though the traditional sectors remain the five largest in Boston, high growth sectors -- instruments, electrical equipment, transportation equipment, chemical products, and rubber and plastic products -- have assumed more prominence since 1975 than they held in the past. Employment growth in these sectors, which capitalize upon Boston's medical and educational institutions and its labor force, is projected to continue and to offset slight declines in some of the traditional sectors.

But some impacts of growth and change may jeopardize manufacturing in Boston. Changes in land use and in the industry itself raise development policy issues. As commercial and institutional developers are able to outbid traditional manufacturers for downtown space, some firms which rely on that area's land and labor characteristics are threatened with dislocation. Employees accustomed to working near their homes are threatened with unemployment. Simultaneously, new growing firms can successfully compete for space. Their location decisions could benefit the City's manufacturing base.

Requisite skills for manufacturing jobs have changed in the past twenty years due to the decline in traditional sectors, automation, and the growth of high technology firms. Workers skilled in traditional operations may lack training appropriate for employment in the high growth sectors or in the growing service industry. To help workers re-adjust, to improve their employment prospects, and to provide the industry with a well-qualified labor force, appropriate training programs are required.

This chapter provides background information on the changing characteristics -- employment levels, types, location, and size -- of manufacturing in Boston. It describes the City's current strategies to maintain and strengthen the industrial base, and it outlines issues to consider in formulating development policy.

MANUFACTURING TRENDS AND CHARACTERISTICS

Industry-wide Employment

The number of manufacturing jobs in Boston has stabilized for the past seven years at approximately 51,000.[2] The current employment level, though substantially lower than in peak years, signifies a marked improvement over trends that began around World War II. Between 1950 and 1975, the City lost 50,000 jobs, partly through the closure or relocation of firms in New England's traditional manufacturing sectors. Though Boston's loss was part of a region-wide decline, it was exacerbated by naval base closings and a reduction in port activity.

Manufacturing's prominence in the local economy also diminished, as employment in the service industry increased. In 1948 manufacturing jobs accounted for twenty-nine percent of private employment. Retail trade, fire, insurance, and real estate (FIRE); and services accounted for forty-five percent. By 1980 manufacturing jobs slipped to 9.3 percent of the total number of private labor force positions, and the share of service-related jobs rose to _____ percent.

The City's share of manufacturing employment dropped from thirty-five percent in 1950, to seventeen percent in 1981 within the Boston Standard Metropolitan Statistical Area (SMSA). Attracted by the amenities of suburban industrial parks -- inexpensive land, modern layouts, and convenient access to highways -- high growth firms located there, a relatively small share of the SMSA's. The City has captured fast-growing high-technology market, even though employment levels have increased in Boston. Traditional industries declined for many reasons. Some closed, some moved to southern states or to less expensive land in the suburbs. Others remain in Boston, but by employing more efficient technology, they have decreased their workforce.

While lost jobs are significant, some changes in employment levels have resulted from more efficient methods of production. Now that firms have adjusted their work forces to mesh with new manufacturing technologies, employment has reached a steady state and is projected to increase slightly in the 1980s. Forecasts predict that Boston will gain almost 4,000 net new manufacturing jobs by 1990, based on trends in high growth sectors which now comprise a large share of the growth in the City's manufacturing base (Tables III-1 and III-2). Manufacturing will continue as a solid component of the local economy.

Traditional Sector Employment

The top five sectors employed nearly seventy-five percent of the manufacturing work force in 1962. That share had dropped to sixty-nine percent by 1981. The decrease stemmed from employment gains in high growth sectors and from major contractions in two traditional sectors: between 1962 and 1981, apparel and food products firms cut their work forces by sixty percent. Compared to a city-wide trend in manufacturing employment showing a forty percent loss between 1962-1981, the other traditional sectors fared better. The largest sector, printing and publishing, reduced its workforce by thirteen percent, and non-electrical machinery declined by only four percent. Unlike the others, fabricated metals manufacturers have employed eleven percent more workers than in 1962.

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Examining 1962-1981 trends tells little about the recovery and stabilization some traditional sectors have experienced after the 1974-1975 recession. Since 1975, employment in the printing and publishing industry has increased its workforce by two percent, in part because of its ties to Boston's growing service industry. Employment in non-electrical machinery production increased by five percent. Fabricated metals manufacturers increased their labor force by eight percent, according to the Massachusetts Division of Employment Security. Although the apparel sector continued to register some losses, its rate of decline diminished as its most stable segment, women's clothing, assumed a larger share of apparel manufacture. Food products lost significant numbers of workers (Table III-3).

In the 1980s, employment in the printing and publishing industry is expected to increase moderately, but some of Boston's large, mature sectors -- food products, apparel, leather, textiles, and furniture -- may have some employment losses. The resource-based manufacturing sectors -- lumber and wood; stone, clay, and glass; and primary metals -- show little growth potential, but they have never been significant components of the City's manufacturing base.

High Growth Sector Employment

Since 1975, growth in durable goods manufacture has offset some of the decline in traditional sector employment. Transportation equipment firms added eighteen percent more workers; rubber and plastics producers more than doubled their work force. Electrical and electronics grew by thirteen percent. Instrument manufacturing firms increased employment by seventy-eight percent, and chemicals by over fifty percent.

Growth is expected to continue in some sectors (Table III-4). Durable goods production should grow fastest, particularly in the manufacture of electrical equipment, instruments, non-electrical machinery, and transportation equipment. This trend reflects national and regional growth in the manufacture of high-technology goods. Rubber and plastics, petroleum, chemicals, and other synthetic goods production show positive growth trends. Though these sectors constitute only a small part of Boston's manufacturing base, their growth will increase employment opportunities.

Size of Manufacturing Firms

Most manufacturing firms in the City are small, according to a 1983 study by EDIC (Table III-5). Over eighty percent employ fewer than fifty workers; about forty percent employ fewer than ten. The predominance of small firms in Boston should help to maintain the City's neighborhood economic base. Despite the predominance of small firms, medium-sized and large firms have a greater impact on employment levels. Medium-sized firms, employing fifty to one hundred workers, constitute eleven percent of the firms and generate fifteen percent of the manufacturing jobs in Boston. Firms with over one hundred employees account for sixty percent of the manufacturing jobs. In contrast, small firms, those employing less than fifty workers, provide only one-quarter of the jobs. Larger firms, while small in number, dominate the employment in Boston's five traditional industries, as well as in chemicals, primary metals, electrical equipment, and instruments (Table III-6). Expansions and contractions of these large firms are major factors in the health of Boston's manufacturing base.

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Longevity of Manufacturing Operations

New firms play a small role in industrial growth, as 950 established manufacturers accounted for eighty-six percent of the 51,000 manufacturing jobs in Boston in 1981. In contrast, thirty new firms generated nearly one thousand jobs. Firms which left the City or ceased operations had a greater impact on net employment. Between 1977 and 1981, seventy companies which employed a total of 2,400 workers moved from Boston. Another 189 companies ceased operations, representing a loss of 4,170 jobs.

Location of Manufacturers

Over half of Boston's manufacturers and over half its manufacturing jobs are concentrated in Central Boston, the vast majority of them Downtown and in the industrial section of South Boston, Fort Point Channel, contained within the study area boundaries, includes most of the industrially-zoned land in South Boston. Ten percent of the City's manufacturing firms and jobs are located in Back Bay/Fenway/ South End, and the remainder are found elsewhere in Boston, but particularly in Roxbury.

Downtown accommodates twenty-four percent of the City's manufacturing firms and twenty percent of the jobs. The apparel, printing and publishing, instrument products, and food industries account for eighty percent of these jobs, and, with a few exceptions, the firms tend to be small.

Downtown, firms tend to cluster in lower rent areas, such as Chinatown and the Leather District. Remaining there is of particular importance to some of them. Printers and publishers choose to be near major customers. Apparel manufacturers rely on their proximity to workers from Chinatown; forty-four percent of the garment workers are employed there. In addition to firms from the traditional sector, some high-growth manufacturers are located Downtown. Approximately eighty-two percent of instruments sector employees work there.

Downtown is losing its prominence as a manufacturing location, although development strategies can help to maintain a solid base of industry there. Faced with competition for space from commercial and institutional developers, some firms may close or migrate. The plight of Chinatown's garment industry is illustrative.[3] Approximately 185 apparel manufacturers are located in Chinatown, and traditionally they have drawn their work force from residents in the area. Institutional expansion caused thirty-five firms, employing two thousand workers, to seek relocation assistance from Boston's Economic Development and Industrial Corporation (EDIC/Boston). The agency has helped those firms with immediate needs for space to relocate within the City, and EDIC is now developing alternative industrial space for the garment companies and other manufacturers, by renovating the underutilized Boston Army Base located in South Boston, near Chinatown. When redeveloped, the former Army Base will provide 1.4 million square feet of net leasable space to any industry in the City under pressure to relocate because of rising rents or expansion needs. Companies now located around Fort Point Channel and North Station and which are jeopardized by Downtown expansion, should find the Base a suitable facility in which to relocate.

South Boston houses twenty-six percent of Boston's manufacturing firms. With 10,827 jobs, South Boston firms employ the largest percentage of manufacturing workers in the City (twenty-one percent). Some firms in South Boston are similar to those found Downtown: printing and publishing firms in this area employ nineteen percent of that industry's workers, apparel firms employ fifteen percent, and electrical equipment companies employ twenty-eight percent. South Boston dominates in the number of workers employed in fabricated metals manufacture, with sixty-nine percent of that industry's work force. Firms located here are large, with four of them accounting for most of the area's nearly eleven thousand jobs. The remaining firms employ less than 150 workers.[4]

The Back Bay/Fenway/South End area has ten percent of the City's manufacturing jobs, most of which are in printing and publishing, and chemicals (eighty-four percent in 1981). While nearly thirty percent of the City's printing and publishing jobs are located in these areas, some printers and publishers have moved to South Boston. Three large firms account for fifty-nine percent of the jobs that remain.

Some manufacturing firms are located elsewhere within the study area's boundaries. Food products firms are found in Charlestown. Transportation equipment firms are concentrated in East Boston, as are some apparel and jewelry/silver plate ware manufactures.

DEVELOPMENT ISSUES

To maintain its existing industrial base and foster the expansion of growing sectors, the City needs to continue addressing several important issues. One major issue facing manufacturing firms is the threat of displacement from commercial and institutional expansion. While some high technology firms can afford to compete for prime locations, many of Boston's traditional industries may have to relocate. Chinatown's garment companies are and firms in other areas will experience similar pressures. Commercial development along Fort Point Channel, construction of a Federal office building at North Station, redevelopment in the South End and at South Station will all remove manufacturing space.

EDIC/Boston has implemented several strategies to address this issue. They include developing attractive space in alternative locations, instituting marketing programs, and providing financial assistance and real estate listings to firms needing help. One of the most important facets of the City's industrial policy has been to develop areas of Boston which offer relocation and expansion opportunities. The development of Boston Army Base and Boston Marine Industrial Park has significantly increased the prospects for retaining manufacturing firms as part of the City's economic base. In order to encourage commercial expansion without jeopardizing the future of manufacturing, other likely sites in the City for industrial activity should be promoted. Opportunities currently available include the industrially-zoned area of South Boston, the Army Base, and the Fargo Building.

Zoning is one of the City's mechanisms for guiding development. In maintaining industrially-zoned areas of Central Boston in the face of pressures from the development of other uses, the City has affirmed its commitment to its manufacturing sector. As development proposals are reviewed in the future, that commitment should be maintained. The City should continue to assist in retention and relocation efforts, looking for solutions in a city-wide context.

Equally as important as locations and levels of employment are the types of jobs created and kinds of skill required by the changing industry. Skills required for manufacturing jobs have changed as employment in traditional sectors has declined. Modernization within traditional sectors, and growth in high technology sectors and in the service industries require different sets of skills. To adjust, workers require training. Budget cuts in publicly-supported training programs have curtailed some re-education efforts. But the City, in cooperation with the Private Industry Council, has instituted new training programs. EDIC's/Boston Technical Center offers industrial training programs tailored to needs of specific companies. Additional efforts to help with skills readjustment should be part of the City's development strategy.

NOTES

1. See "City of Boston Employment Projections", Tables 22 and 23.

2. John Accordino, draft report, "Boston Manufacturing Universe", Economic Development and Industrial corporation/Boston, 1983. Unless otherwise noted, manufacturing data from this source provides the information combined in this chapter.

3. For additional information, see "The Garment Industry: Will It Survive in Boston"?, EDIC/Boston, June 1981.

4. Accordino, p. 20.

MANUFACTURING TABLES

VISITOR-RELATED FACILITIES

INTRODUCTION

Boston's visitor-related sectors -- its convention, tourist, and hotel industries -- are major components of the City's, and especially Central Boston's, economy and contribute significantly to local employment and tax revenue. Growth in each of these sectors is sensitive to the City's overall stability because of the interrelationships all the commercial sectors. The growth in office space and retail activity, for example, depends partially on the availability of hotels rooms to serve the business visitor and the presence of tourists to purchase goods in Boston's stores.

While the health of the visitor-related sectors is closely linked to that of Boston's office, retail, and institutional sectors, it also relies on the success of the visitor-related sectors themselves. The convention market, for instance, can only expand to the limits of the supply of hotel rooms. Likewise, without sufficient convention facilities, hotel occupancy rates decline.

Given the symbiotic relationship amongst the commercial sectors and within the visitor-related sectors themselves, this section focuses on how those inter-relationships will affect the 1992 hotel market. It describes the current status of convention and gate show facilities, tourist attractions, and the hotel market. As well, this section includes projections for future growth for each sector and outlines what actions may affect that growth. Some actions are directly related to development policy: the need to expand the Hynes Auditorium, the need for aggressive marketing of visitor-related facilities, and the need to ensure a price range for hotel rooms that would encourage tourists, as well as business visitors and conventioneers, to visit Boston.

CONVENTIONS AND GATE SHOWS

Boston's success in attracting national and regional meetings depends primarily on the availability and quality of its gate show, convention, and hotel facilities. Although facilities for conventions and gate shows sometimes serve overlapping markets, generally each provides for distinct spatial needs. In addition to exhibition space, conventions require more meeting rooms and auditoriums than do gate shows, which need exhibition space primarily. Now and for the next few years, the City is better equipped to draw gate shows. Inadequate convention facilities and the limited price range for accommodations hamper efforts to expand the convention market here. As a result, the City and the Commonwealth are losing potential increases in business and tax revenues. (Two sorts of convention markets exist: one is those groups needing large spaces which only convention centers provide; the other is smaller groups whose spatial needs are met by hotel facilities. This report focuses on the first market.)

Facilities

Currently there are two major gate show and convention facilities in the City. Hynes Auditorium, a publicly-owned convention center, offers meeting, exhibition, and auditorium space. The Hynes can accommodate gate shows, but because these regional attractions generate high volumes of traffic, congesting

streets in adjacent neighborhoods; the Hynes limits its gate shows to twenty-two annually. Bayside Exposition Center, a new privately-owned gate show facility, has more exhibition space than the Hynes and is better sited for handling traffic. It has minimal facilities for meetings and large assemblies. Occasionally, other large facilities, such as Boston Garden, provide space for gate shows.

A third major facility, Boscom, will be developed soon. Massport has leased Commonwealth Pier, formerly a gate show facility, to a private developer to create a high-technology trade mart. Reconstruction of the pier will provide 785,000 square feet of exhibit sales space, of which 500,000 square feet will be allocated for permanent showrooms and 55,000 square feet for meetings. Although Boscom will serve primarily as a center for marketing high-technology products to trade representatives, 15,000 square feet will be available for general trade, gate shows, or conventions.

Hynes and Bayside now compete with four other facilities in the New England region: The Northeast Trade Center (a privately-operated gate show facility in Woburn); and the Springfield, Worcester, and Hartford Civic Centers. The civic centers provide arena and/or large auditorium space, as well as rooms for exhibits and meetings. The regional facilities are all well equipped for holding gate shows and small conventions.

Trade shows, in particular, book space at the Northeast Trade Center, and gate shows use the Bayside Exposition Center. However, because both these private facilities are more expensive than public ones, many groups prefer to use regional public facilities in Worcester, Springfield, Hartford, or Boston. The Worcester and Hartford Civic Centers, similar in size, attract some former patrons of the Hynes Auditorium. However, size limitations and lack of hotel rooms restrict the ability of some regional facilities to compete with those in Boston, as well as their ability to attract much new business to New England.

Outside of New England, major competitors for Boston include seven East Coast convention centers located in New York City; Atlantic City; Philadelphia; Atlanta; Washington, D.C.; Baltimore; and Miami. All these facilities have large exhibit halls and are well supplied with meeting and hotel rooms. In comparison, the Hynes Auditorium is a small facility. Table IV-1 lists the characteristics of the major East Coast exhibit facilities.

The Hynes Auditorium attracts approximately thirty conventions per year, a capture rate of five percent. Currently, few cities are able to draw more than fifty conventions annually. However, the national convention market is expected to grow by nearly five percent annually.[1] It is estimated that eighty percent of future convention groups will be similar in size to those now booking the Hynes; twenty percent will be larger. Depending on plans to expand the Hynes, Boston could attract nearly twelve percent of the market (approximately seventy groups) by 1990.

Recognizing the potential benefits of expanding the Hynes Auditorium, the City, assisted by a State grant, hired consultants to conduct a feasibility study. Of the options developed, the City selected one which would add 210,000 gross square feet of exhibition space, 36,000 gross square feet of conference/exhibition space, and 72,000 gross square feet of meeting rooms.[2]

If the site could accommodate the program and if 5,000 additional hotel rooms were built, Boston could more than double the number of conventions held in the City annually.

Upon completion of the feasibility study, the City retained other consultants to develop a schematic design. Simultaneously, the Commonwealth purchased the Hynes Auditorium and instituted the Massachusetts Convention Center Authority, which is now reviewing the City's plans for the Hynes.

TOURISM

Between 1970 and 1982, tourism in Boston grew at an annual rate of 4.8 percent, and in 1982 714,000,000 tourists visited the City. Although attendance counts at major attractions declined slightly in the past few years, tourism may continue to grow, though not as significantly as in the 1970s. Tourism will increase at an annual rate of 3.3 percent to 1992. According to this projection, 7,066,000 tourists will visit the City in 1992. This growth, together with a projected increase in the hotel capture rate, would almost double the demand for additional tourist hotel accommodations and related services, increasing the attendance at various cultural events and stimulating new development in hotel, retail, and cultural facilities.

Past and projected growth stems, in part, from revitalization efforts in Boston. Prior to the country's Bicentennial celebration, many of the City's more than three hundred historic and cultural attractions (Table IV-2) were improved and remain in good condition today. The redevelopment of Faneuil Hall into a marketplace, improvements to Downtown Crossing, and the continued growth of retail in Back Bay increased the attractiveness of shopping in the City. Projects recently completed or under construction, such as the State Transportation Building, a hotel and condominium complex, and a new retail center, will help revitalize the Theater District. Renovations to several theaters -- the Shubert (competed), the Metropolitan Center (in progress), and the Saxon (planned) -- will improve both the quality of performance facilities and the image of the district.

Revitalization has contributed to Boston's share of tourism -- nearly one-quarter of tourist business in Massachusetts.[3] (The Commonwealth as a whole draws 2.3 percent of the national tourism). But factors external to the City also play a role. The number of foreigners traveling to the U.S. is increasing, and national tourism is projected to grow six percent annually in the 1980s. Both trends should be reflected in tourism here as well. However, the number of tourists who will visit Boston depends on the number of moderately-priced accommodations, which are currently in short supply. As well, the growth of tourism is vulnerable to changes in the national economy, such as the 1974-1975 and 1982 recessions.

HOTELS

Prior to 1981, there was little hotel construction in Central Boston in recent decades. During 1981 and 1982, four new hotels and one addition were constructed, increasing the City's stock of hotel rooms by 1,332. By late 1982, construction began for four more hotels (a total of 2,743 rooms). When

construction is completed, the additional hotels will increase the number of rooms in Boston to eleven thousand by the end of 1985. (This factor includes the loss of one hundred units in the Essex Hotel conversion.) This development reflects the continued growth of the local economy, an increase in tourism, and the expectation that the City's convention facilities will be expanded. But it may also pose some problems, if the supply of rooms and demand for them do not mesh.

Hotels in downtown Boston contained 7,925 rooms in 1982. Over one-half of the rooms (sixty-one percent) were classified as luxury (Class A); approximately one-third were moderately priced (Class B); the remainder (nine percent) were inexpensive (Class C). Forty-six percent of the guests were business visitors, a group which accounts for much of the demand for luxury accommodations. Thirty-four percent of the hotel guests were conventioneers, and only about twenty percent were tourists. Table IV-3 shows the 1982 distribution of hotel rooms by class of room, as well as the distribution of room sales amongst business visitors, tourists, and conventioneers.

A comparison of Boston's hotel stock with that of other major East Coast cities indicates that Boston's mix of rooms departs from proportions found elsewhere. Boston has the smallest share of inexpensive rooms. As well, the City has a greater proportion of expensive rooms than is found in all other major East Coast cities except Miami.

Future Hotel Market

A range of factors influence the future hotel market. Many of them, such as fluctuations in the national economy, are beyond the City's control. Other factors, such as the provision and promotion of convention facilities; the development of office space; and the location, timing, and type of hotel construction are affected by the City's actions. The hotel market projected over the next decade is based upon an analyses of the various factors affecting the supply and demand. Demand factors analyzed here include growth projections for the number of business visitors, conventioneers, and tourists coming to Boston. Supply factors include the 1982 inventory of hotel rooms, the number of rooms scheduled for completion by 1985, and the number of rooms proposed for construction by 1992. The projections are based on the assumption that the Hynes Auditorium will be expanded between 1986 and 1988. As well, the projections offer two occupancy rate scenarios outlined in "The 1983 Annual Report of the Greater Boston Convention and Tourist Bureau". One scenario assumes an aggressive marketing campaign, the other assumes no additional marketing.

- Business-related Demand

  Downtown employment is projected to grow at an annual rate of two percent, rising from 297,000 jobs in 1982, to 362,000 jobs by 1992. To generate business-related demand for hotel rooms, the employment projections were used in conjunction with a ratio of rooms demanded per employee. Currently, it is estimated that each Downtown employee creates an annual demand for 3.48 rooms, but it is assumed that the ratio will increase, that more business activity will create a relatively greater number of rooms demanded per employee. The ratio used in projecting demand between 1982 and 1992 is 4.9 rooms per employee,

yielding a forty-one percent increase in demand between 1982 and 1992. Table IV-4 indicates the projected demand generated by business visitors.

- Tourist-Related Demand

  The supply of moderately-priced rooms in the City is inadequate for meeting the present demands of tourism. Tourists often stay in hotels elsewhere in the metropolitan area. In the communities adjacent to Boston, there are over 2,800 hotel rooms (14,000 rooms existing or under construction in the entire metropolitan area), and the majority of them are moderately priced.

  The future demand for hotel rooms generated by tourists, is a function of Boston's ability to attract the market currently drawn elsewhere in the metropolitan area, as well as the growth rate for tourism. Tourism is projected to increase by 3.3 percent annually to 1992, based on an analysis of national and regional tourist projections. The regional market capture rate is based on an assumption that developers will supply moderately-priced hotel rooms and, therefore, will accommodate 11.4 percent of the regional tourist demand -- a 3.2 percent increase over recent demand. (Table IV-5 delineates the tourist demand for hotel rooms.)

- Convention-Related Demand

  The future demand for hotel rooms generated by conventioneers, depends on the development of a new or expanded convention center.[3] It is estimated that an optionally-sized convention facility would be one which could accommodate small to medium-sized convention groups, rather than one of a magnitude to accommodate very large groups. The larger groups require far more than five thousand hotel rooms, in addition to extensive convention center facilities. By attracting the smaller groups, Boston could double its present number of conventions held in the Hynes Auditorium.

  If convention facilities are not expanded, the hotel business will suffer from an excess of rooms. Even if plans are finalized, lengthy delays in expanding the Hynes Auditorium -- while other East Coast facilities are being developed -- will limit Boston's ability to attract a large share of the national market for many years hence, since conventions are typically booked five years in advance. (Table IV-6 indicates the convention-related demand for hotel rooms.)

- Replacement Demand

  In 1978 it was estimated that approximately six hotels with a total of 2,250 rooms would need to be refurbished or replaced. All of these hotels provide Class B and C space, and their renovations are important to maintaining that stock. However, conversion of the Essex Hotel to a two hundred unit luxury facility designed for extended visits will remove three hundred Class C rooms from this group.

Future Hotel Supply

A telephone survey of hotel operators conducted in 1981 and a summary of the current supply of projects scheduled for 1985 completion, and of those proposed for construction by 1992, give an indication of the future supply of hotel rooms in Central Boston.

According to the survey, most hotel operators aim to capture the top of Boston's market, the business traveler. This market commands the most expensive rooms and in also the most stable hotel business in the City. But most hotel operators are interested, as well, is attracting a mix of guests that approximates the current market proportions -- fifty percent business, thirty percent convention, and twenty percent tourism. Because tourist demand is considered a lower-priced and weekend market, no hotels have been planned primarily for that market.

A review of the projected 1985 supply indicates a room distribution similar to that described by the hotel operators. Nearly all of the hotels are intended for the Class A market, as Table IV-7 indicates. The only inexpensive rooms which might be generated, would result inadvertently from new construction. Some existing Class A and B hotels might be forced to lower their rates to remain competitive, and they could fill the market for less expensive accommodations. Table IV-8 summarizes the current and projected supply of hotel rooms.

In 1978, prior to the boom in hotel construction in the 1980s, the hotel occupancy rate was seventy-seven percent and exceeded the generally acceptable occupancy level of seventy percent. (This rate ensures an adequate supply for times of peak demand.) As new hotels opened, the occupancy rate dropped to 68.4 percent. Because the timing of the Hynes Auditorium expansion has been delayed, hotels now under construction, which were planned in anticipation of increased demand from conventioneers, will not receive the business once expected by 1985. 1985 occupancy rates are projected to be 64.6 percent with marketing, and only 48.6 percent without marketing. Assuming the Hynes will be expanded, by 1992 and occupancy rate will rise to the acceptable level of seventy percent (Table IV-10).

SALES, EMPLOYMENT, AND TAX REVENUE

Revenues from visitor-related industries are generated in three ways. The most substantial revenue comes from direct and indirect sales in retail, restaurant, and hotel trade, as well as transportation. Personal income of the 28,000 people employed at visitor-related facilities accounts for the second largest source of revenue. City and State tax receipts are the third source.

Of the three industries, tourism accounts for forty-four percent of the total revenue generated, business and conventions for twenty-two percent. Tourists, although accounting for the lowest hotel room requirement of the three sectors, generate more employment and tax revenue than either business or convention visitors.

Although salaries generated by visitor-related employment constitute a significant share of revenues, the salaries are generally not high. Jobs created by hotel, tourist, and convention industries are found within the industries

themselves and in related services, such as restaurants, retail stores, and transportation facilities. The 4,400 people employed in Boston's hotels work at low-skilled (sixty-six percent) and medium-skilled (twenty percent) jobs. Jobs and salaries created in related services are at levels comparable to those in the hotel industry.

In revenues derived by the public sector, the Commonwealth benefits more from visitor-related businesses than the City does, under the current tax structure. The Commonwealth receives tax receipts from hotel room, liquor, meals, sales, as well as from corporate and personal income. The City receives only the property tax benefits from the hotels and related commercial enterprises (with a small percentage of the State-collected sales tax returning to the City in the form of local aid).

DEVELOPMENT ISSUES

Despite the promising projections for the growth of Boston's visitor-related sectors, several issues related to future development require resolution.

First, achieving the growth projected here depends on the timing of the Hynes Auditorium expansion. Because convention groups book space years in advance, the uncertainty surrounding the expansion may adversely affect the hotel business and diminish State and local revenues.

Second, the projections emphasize the need for marketing visitor-related facilities. In 1985, according to the Greater Boston Convention and Tourist Bureau, a successful marketing program could make a sixteen percent difference in the hotel room occupancy rate, thus recouping some of the loss attributed to the delayed expansion of convention facilities. The State, which now owns the Hynes and which would receive substantial increases in revenue from its expansion, should initiate such a marketing program.

Third, the range of prices for hotel rooms is likely to become imbalanced. In 1982, the price range distribution of rooms was sixty-one percent Class A, thirty percent Class B, and nine percent Class C. An optimal range would approximate that of 1982, perhaps with a slightly greater proportion of Class B rooms. This would serve two purposes. It would encourage overnight visits by tourists, who generate more local revenue than do business visitors and conventioneers and, it would make Boston more accessible to visitors of modest means. However, the hotel supply projected for 1985 completion and that planned for 1992, would add a disproportionate number of Class A rooms.

Resolving the development issues will require the continued coordination of State and local efforts, as well as the cooperation of businesses within each of the visitor-related sectors.

NOTES

1. Peat, Marwick, Mitchell and Company, "A Report on Boston's Convention Market and the Expansion of Hynes Auditorium", Boston Redevelopment Authority and Boston Public Facilities Department, September 1981.

2. Exhibit facilities are measured for sales purposes in terms of Net Square Feet (NSF), i.e., the amount of space which an exhibitor can rent. This dimension for space planning purposes must be doubled to account for the circulation areas in order to arrive at the gross floor area of exhibit space. Hynes has currently 75,000 Net Square Feet (i.e., a total of 150,000 gross square feet), of which 45,000 NSF is located on the plaza level and 30,000 NSF on the grade above. Meeting rooms are located on both levels. Additional square footage for lobby and service areas is also provided but not counted in the gross square footage calculations.

3. Boston Redevelopment Authority, "Hotel and Convention Center Demand and Supply in Boston, Past, Present and Future", March 1979, P. VI-3.

VISITOR-RELATED FACILITIES TABLES

INSTITUTIONS

INTRODUCTION

Boston's image, nationally and globally, is closely tied to its pre-eminence in education and medicine. In turn, these fields have increased the local economic base and produced jobs for Boston Residents. They have also helped to expand the economy of the Boston metropolitan area: these institutions have been integral to the growth that the metropolitan region has witnessed in the high technology and bio-medical areas. This latter field is expected to become a major growth sector in the 1980s and 1990s. In recent years, the expanding needs of medical and educational institutions have generated major development projects.

Not all of this growth, however, has benefited residents of Boston's neighborhoods. Institutional expansion has created adverse impacts. In addition to removing property from the tax rolls, some expansion has displaced long-term residents. Blight created by institutional land banking and spiralling property values associated with land speculation, have eliminated potentially viable neighborhood residential and commercial uses. Where institutional development has not been coordinated and/or planned with the City and its neighborhoods, opportunities to improve existing conditions have all but slipped away.

This section will focus on the City's educational and medical institutions, describing their growth over the last twenty years, projecting trends for this decade, and discussing issues generated by new development. Cultural institutions are described in the visitor-related facilities section of this report.

INSTITUTIONAL CHARACTERISTICS

Medical and educational institutions are major employers in Boston; over ten percent of employees in the City work in colleges, hospitals, and medical facilities. Amongst the largest employers are Boston University, Northeastern University, Massachusetts General Hospital (MGH), Tufts-New England Medical Center (TNEMC), and Brigham and Women's Hospital. Boston University alone employs over 5,000 facility and staff, as well as providing part-time employment to approximately 6,000 students. TNEMC employs approximately 3,500 full-time equivalent workers. Nearly sixty-five percent (57,000 jobs in 1980) of city-wide employment in the two fields is located in Central Boston.

The physical expansion and renovation which has accompanied employment growth in some institutions has been impressive. Between 1975 and 1982, medical institutions added nearly three million square feet with an accompanying employment growth of ____. Educational institutions added 500,000 square feet, despite a lack of employment growth. Combined, construction for both sectors accounted for nearly one-quarter of development in Central Boston during the five-year period. Table V-1 provides a list of recent expansions.

Medical and educational facilities currently account for over seven million square feet, (more than ten percent of the gross floor area) in Central Boston. Most of this space is devoted to the activities of major hospitals such as Massachusetts General Hospital and Tufts-New England Medical Center.

Tufts-New England Medical Center, located in Chinatown, is the largest institutional complex Downtown. Though MGH and TNEMC stand out as the largest medical institutions in Central Boston, the Longwood Medical Area in the Fenway serves as a center for health care and research. Within its boundaries are six hospitals, the Harvard Medical School, Massachusetts College of Pharmacy, the State's Mental Health Center, as well as several educational institutions.

Educational facilities occupy less space than do medical facilities, but their physical presence in Boston, and especially in Central Boston, is nonetheless significant. Geographically, the Fenway has the greatest concentration of colleges and universities, including City's the largest -- Boston and Northeastern Universities. Suffolk University, New England School of Law, and Emerson College are all located Downtown, and together they fill over half the educational space in Central Boston. (Boston University which has extensive facilities, falls outside of Central Boston boundaries.)

INSTITUTIONAL PROJECTIONS

Medical institutions are expected to grow more than any other industry in Boston in the 1980s. As the demand for medical care rises, employment is projected by 1990 to increase by 17,000 people (Table V-2). Several factors account for this high growth prediction. First, the elderly will constitute an increasingly greater proportion of the population nationally and locally, and people in this age group will continue to have greater health care needs than do younger groups. Second, as health care needs grow nationwide, institutions in Boston -- the country's center for medical care and research facilities -- will expand to meet those needs. Third, recent trends indicate that medical institutions are increasing their levels of capital investment with the support of public and private funds. Examples of this trend are recent expansions by MGH, BWH, TNEMC, and Beth Israel Hospital.

Increased emphasis on research activities, the need for medical office space, and institutional consolidation to provide improved care and economies of scale have fueled many development projects. The proposed health care cost containment legislation at the State level could dampen growth in the 1980s but, given the strength of the health care providers and current national growth trends, legislation is unlikely to significantly affect long-term growth.

Institutions of higher education, which expanded substantially to accommodate the post-World War II baby boom, will not increase their employment levels in the 1980s. Though educational institutions now account for one-fifth of institutional employment in Central Boston, that share may decrease slightly as levels of employment grow in medicine. Enrollment at Central Boston's larger campuses might decline due to fewer high school graduates and the low national birth rate. However, some schools are developing or expanding vocational and adult education curricula in an attempt to counter declining enrollments.

Major projects planned, underway, and recently completed will add approximately 2.5 million square feet to Central Boston's institutional inventory (Table V-1). Medical institutions will expand more than others, spending close to three hundred million dollars for development by 1990.

DEVELOPMENT ISSUES

Institutions have played a key role in the City's growth. Providing jobs and public services, they have added to the local economy and to Boston's reputation as a center for medicine and education. Some institutions' physical development has benefited Boston's architectural character. MGH, for instance, recently relocated its old and distinctive physician's residence to a prominent location on Cambridge Street, rather than demolish it to make way for expansion. Other institutions such as the Children's Museum and the Institute for Contemporary Art, have created new uses for obsolescent buildings. The Museum relocated from Jamaica Pond to renovated buildings on the waterfront, and ICA renovated an old firehouse on Boylston Street.

However, not all of this growth has been positive. Aggressive expansion has reduced the City's housing supply. Institutional expansion into adjacent Central Boston neighborhoods, such as the Fenway, Back Bay, the South End, and Chinatown, has led to residential displacement, particularly for the elderly population.

Institutional growth can have a negative effect on the City fiscally, if that growth is not carefully controlled. The non-profit status of institutions exempts them from local property taxes. In Boston over sixty percent of property is tax exempt. While a large portion is owned by the Federal, State, and City government, medical and educational institutions account for over fifteen percent of the total exempt property. Their share has increased substantially over the past fifteen years.

Though not all institutional growth has generated such direct and severe impacts, it also has not always brought the benefits it might. Too often, institutional planning has been completed in a "piece-meal" fashion and has missed opportunities to improve both the institutional complex and adjacent areas. Thus, institutional development often falls short of its potential to provide for the needs of its employees and neighbors. Plans allowing a mix of uses could promote vitality in fairly sterile and dull institutional areas, serve the needs of people living and working their, and help improve public safety. This becomes especially important where major institutional complexes, such as Tufts-New England Medical Center, Massachusetts General Hospital, Northeastern University, and the Longwood Medical Area, are located near key revitalization areas in Central Boston.

Planning coordinated amongst the institutions themselves could lead to more substantial benefits for individual institutions and minimize their need to acquire additional properties for expansion. This coordination would be beneficial because, as universities and hospitals compete for students and funding, each tends to build the largest and most up to date facilities with little thought to collaborative use amongst institutions, and duplication of facilities is an expensive use of land and capital. In the energy and service

areas, institutions have developed some projects jointly, such as the Harvard Power Plans and Medical Service Area Corporation's activities for Longwood Medical Area's eleven institutions but few research and office buildings are shared.

PUBLIC POLICY AND INSTITUTIONS

To maximize the benefits and minimize undesirable impacts of institutional growth, the City employs several policy tools: in-lieu-of tax arrangements, intensive neighborhood and zoning review, and institutional master plan requirements. Through these, the City requests institutions to help support municipal services; to provide housing and parking for students; to improve the appearance of their facilities and open space; to provide programs and facilities beneficial to neighbors; and to avoid expanding into residential areas.

One policy tool, in-lieu-of tax arrangements, allows the City to recoup some of its lost real estate tax revenue in the form of direct payments and or community services. Typically, applications for the City's approval of institutional development plans have triggered negotiations of lieu of tax arrangements. Often, existing arrangements are updated when institutions propose additional expansion projects and are revised to reflect the increased demand for municipal services that new facilities will create.

The City has signed in lieu of tax agreements with the major educational institutions such as Boston University, Suffolk University, New England School of Law, Northeastern University, and Berklee College of Music. Groups within the medical community which have made agreements with the City include New England Medical Center, the Harvard Community Health Plan, Deaconess Hospital, and the North End Community Nursing Home. Boston University agreed to provide the City with direct payments, to make scholarships available to some students from all of Boston's high schools, and to refrain from removing additional property from the tax rolls after July 15, 1980.

A second policy tool, intensive neighborhood and zoning review, can be used to control the impacts of institutional expansion. In the Fenway, institutional zoning for the East Fens, West Fens, and St. Botolph areas has led to additional public input for institutional proposals. Most institutional uses, including private, elementary, and secondary schools; libraries; museums; adult education centers; some sports facilities; nursing homes, and private clubs, require approval of the City's Zoning Appeal Board as conditional uses, and any changes are subject to community and City review.

A third tool used to guide institutional growth is the City's policy requiring that institutional master plans accompany development plans. In its recent review of Tufts-New England Medical Center's proposed expansion, the City withheld its approval pending submission of an acceptable master plan, one that addresses the residential needs of Chinatown.

In summary, the growth of medicine and education is an important component of Boston's economy but insitutional expansion is not without attendant problems for the City's tax base and neighborhoods. Development policies can minimize the negative effects of institutional growth and, in fact, have

already done so. Development policies can also help to elicit substnatial benefits from institutional growth, but this will require more coordination amongst the institutions, the City, and its neighborhoods, and it will depend on the quality of institutional planning itself.

INSTITUTIONAL TABLES

RESIDENTIAL DEVELOPMENT

RESIDENTIAL DEVELOPMENT

INTRODUCTION

The dynamics of Central Boston's housing market both contribute to and reflect changes taking place city-wide. In some Central Boston neighborhoods, demographic and residential trends deviate from those characteristics of the City as a whole. Nonetheless, changes unique to certain neighborhoods also affect the housing supply and economic well-being of all Bostonians. Even more influential are forces beyond the local jurisdiction. Revisions in Federal housing policy, especially the reduction of subsidies, are of major consequence in Boston where twenty percent of the residents receive some form of housing subsidy. The interrelationships of changes occurring at Federal, State, city, and neighborhood levels give rise to some major issues to consider in formulating residential development policies for Central Boston. To summarize from the background information which follows, the issues include:

Overall Housing Opportunities

While the overall number of housing units in the City has increased slightly, the changes in population -- age groupings and lifestyles -- will increase the demand for residential units well beyond anticipated residential development.

Mixed-Income Residential Development

Although some of the residential development projects now under construction will include subsidized and moderate-income dwelling units, current federal housing policy will vastly reduce housing opportunities for low- and moderate-income residents during the next decade. In the absence of federal subsidies, the private market will be less able and willing to provide new, affordable housing. In those parts of Central Boston where residential developers face stiff competition from commercial and institutional developers for limited real estate, prospects for affordable housing are especially bleak.

Displacement

Although change and residential mobility are natural phenomenon in neighborhoods; inflation, housing rehabilitation, and conversion of rental units to owner-occupied housing often force residents to move involuntarily. Many residents have few options when threatened with displacement.

Recognizing that development in Central Boston cannot meet all the demand for additional housing, it is nonetheless important to address the issues listed above and ascertain how development strategies for Central Boston might alleviate some of the problems currently facing residents.

TRENDS AND CHARACTERISTICS

City-Wide

Boston's housing has changed significantly over the past two decades. The changes are reflected not in the number of units but in the composition and location of the housing supply, forms of tenure, and characteristics and needs of residents.

The total number of units has increased only slightly growing from 239,500 in 1960 to 241,000 in 1980 (Table VI-1). Though the supply of housing shows little net growth, it has fluctuated over the past twenty years. Between 1960 and 1970, there was a net loss of 7,000 units. In the following decade, the net addition of nine thousand units more than restored the previously diminished supply.[1]

Composition of the housing supply changed more dramatically. Boston lost 19,000 units of one to four family, owner-occupied housing during the 1960s.[2] Nonetheless, owner-occupancy increased by eight thousand units in the 1970s. Changes in tenure, rather than new construction, accounted for this growth. Nearly four thousand owners moved into previously rented units, and about 4,500 units went into condominium ownership. Only twenty percent of the condominiums were newly constructed. The majority were established through changes in the existing housing mix: 1,780 luxury apartments were converted to an equivalent number of condominiums; 1,913 moderately priced rental units were redesigned to create 1,677 condominiums; and 722 rooming house units were combined into 247 condominiums.[3]

As owner-occupancy increased, the supply of market-rate rental units diminished (Table VI-2). In the 1970s, there was a net decrease of 18,536 units. Subsidized housing assumed a greater share of the housing inventory, growing by about two thousand units in the 1970s. Costs of renovation, new construction, and financing rose, creating disincentives for residential development. The assistance of Federal Section 8 and State-financed programs countered changing economic forces to some extent and attracted residential developers to the subsidized market. As a result, the number of assisted units in the City rose to forty-two thousand in 1980 (Table IV-3). Even with the additional units, demand for subsidized housing outpaced the supply. City-wide, rents had increased by over ninety percent between 1970 and 1980, and the price of homes had climbed by over eighty percent.[4] In the same period, the vacancy rate for available, habitable units dropped from six percent to less than four percent.

Demographic characteristics of residents have changed, as have their housing needs (Table VI-4). Though Boston's population declined by twelve percent between 1970 and 1980, the number of households remained constant. However, the number of families declined and were replaced by substantial increases in the number of small, one- to two-person households. Changes in household size, reflecting the lifestyle preferences of the post-war baby boom population, have produced the current demand for homeownership.[5]

Though the net population declined, the percentage of minority and female-headed households increased. As the "Future Boston" study noted, housing patterns of these groups reflect their generally low incomes. Homeownership is low; minority and female-headed households need more subsidized housing and family-sized units.[6]

Central Boston

Because Central Boston is dominated by commercial land uses, residential use seems less significant in comparison.[7] Viewed in a city-wide context however, housing in the study area provides an important source of revenue and supplies a major share of particular housing types. Central Boston's housing inventory includes much of the City's rental stock: about forty percent of its apartments and an equivalent supply of mixed residential/commercial property. The area also supports approximately thirteen percent of the single-family property in the City (this count includes units owned as condominiums), nearly five percent of the two-family structures, and over seven percent of the three-family buildings.

Residential properties in Central Boston generate substantial tax revenues. In FY 1981, the area's residential and mixed commercial/residential property taxes constituted 27.5 percent of city-wide assessment for such properties; that share amounted to over ten percent of the City's total property tax revenue. Some property types, such as single-family housing, generate a disproportionate share of tax revenue for their numbers in Central Boston, a fact which reflects the value of some Downtown residential properties.

The housing market in Central Boston has both reflected and contributed to many city-wide trends of the past decade, such as the growth of condominium and subsidized housing, higher property values and rents, and smaller household size. But trends affecting Central Boston's market have departed from other general trends. Housing stock increased by eleven thousand units while the number of units city-wide remained constant. The number of people living in Central Boston grew by nearly three percent at a time when the City's total population declined.

Central Boston's Neighborhoods

A composite of housing in Boston, or even in Central Boston, shows overall trends but cannot provide an adequate picture of housing issues confronting sub-areas within the City. Characteristics and needs of residents, composition of the housing inventory, and the potential for residential development vary amongst the City's distinct neighborhoods. The following section outlines some similarities and differences of Central Boston's neighborhoods and describes housing trends and issues that residents face.

Back Bay and the Fenway supply a large proportion of Central Boston's housing, much of it in rental units. Though the number of units increased slightly (2.3 percent with the addition of 500 units) between 1970 and 1980, the supply of market rate rental units has dropped. In 1970 apartments comprised ninety percent of the two neighborhoods' housing stock, but by 1985 the percentage is expected to fall to about sixty percent.[8]

Back Bay's central location, rising market values and the character of the housing stock all encourage and support condominium development.[9] Over two thousand rental units were converted between 1969 and 1979. While the rate has diminished somewhat, condominium conversion still continues.[10] The issue of displacement often associated with condominium conversion does not pose a serious problem in this community, as the majority of its residents are middle- and upper-income professionals. As the rental options continue to diminish, however, the long-term elderly residents of the Back Bay will be adversely affected.

In contrast, the Fenway houses a large student and elderly population which is generally less affluent than that of Back Bay. The real estate market and overall neighborhood stability of the Fenway suffered during the 1960s due to organized arson, real estate speculation, housing abandonment, and institutional expansion. With the infusion of large housing subsidies in the 1970s, the development of some luxury apartments and condominiums, and the increased activity of neighborhood groups, the area is slowly becoming more stable. However, the potential displacement of the low-income and elderly residents, reductions in federal subsidies, and high housing costs will be critical concerns throughout the next decade.

Beacon Hill and the West End are neighborhoods of Boston's affluent residents. Property values have risen in these areas. The supply of housing has increased slightly, especially in the West End, as has the population. Condominium conversion, which occurred at a rapid pace on Beacon Hill in the 1970s, has dropped off in the 1980s.[11] As in Back Bay, displacement of the elderly population and housing affordability are issues of concern.

The North End, traditionally a tightly knit, Italian-American community, has become attractive to newcomers due to the neighborhood's proximity to Downtown, Quincy Market, and the adjacent, revitalized Waterfront. The area is changing dramatically. The percentage of families living in the North End and Waterfront has decreased from sixty-four percent in 1970 to forty-two percent in 1980, and the number of single-person households has increased. Half the residents in the two neighborhoods now live alone. Housing development along the waterfront accounts for much of the change. Underutilized warehouses and wharf space have been converted to luxury rental units and condominiums. The addition of 1,800 units of owner-occupied, market-rate rental, and subsidized units -- a thirty-nine percent increase in the total North End/Waterfront stock -- has created a dynamic market there. Demand is expected to remain strong and affordability to be a major concern.

Reversing the trends that led to urban renewal designation, the conditions of housing in the South End have improved. The supply increased by over twenty-five percent between 1970 and 1980. Population in the area rose by about twenty percent, and the incidence of owner-occupancy is expected to do the same over the next decade. However, new residents are more affluent than most long-term residents living in the area. Condominium conversion and owner-occupancy of rental units have contributed to the loss of apartments and rooming houses, creating problems of displacement and

affordability. The addition of four thousand units of subsidized housing partially alleviated the problem, but conflicts over what income groups will control residential development on vacant land continue to occur in the South End.

Charlestown, the smallest of Central Boston's neighborhoods, is populated primarily by working-class people. Sixty percent of the housing there is one-to four-family, owner-occupied buildings. With the addition of several hundred units in the 1970s, thirty percent of the housing stock is now subsidized.

Family size is declining in Charlestown, as elsewhere in the City, but at a higher rate than in some neighborhoods. Residents are getting older, and population has fallen by eighteen percent. Although there was a loss of homeownership during the early and mid-1970s, middle- and upper-income professionals began to migrate to Charlestown during the late 1970s. The Navy Yard development will add one thousand market-rate rental and condominium units to the neighborhood over the next five years and will inevitably affect the socio-economic mix of the Charlestown community. Again, housing affordability will be a main concern in Charlestown in the coming decade.

South Boston is one of the few neighborhoods in Central Boston which lost housing units between 1970 and 1980. Nearly 450 units were demolished, but only about two hundred condominiums and one hundred subsidized dwellings were developed in their place. As in Charlestown, many residents of South Boston are working-class whose family size has declined. Population in the area dropped by twenty percent between 1970 and 1980, and the number of households fell by six percent. The development of market-rate rental units anticipated for Fort Point Channel will increase the housing supply but will do little to improve housing for the area's current residents.

During the 1970s, one hundred units of housing in East Boston were demolished and an additional one hundred converted to another use. However, a six percent net increase in the total dwelling supply was realized with the addition of one thousand subsidized units.

Boston's central business district is comprised of several distinct subsections, including the Theater, Leather, and Financial Districts; South Station, and Fort Point Channel. Chinatown and South Cove are located on the southern edge of the central business district. Consonant with the term central business district, most of the land uses found in this area are commercial, manufacturing, or supportive service industrial uses. Physical deterioration, building obsolescence, and changing market forces are now creating opportunities for new residential uses in this business district. In particular, the Leather District, Fort Point Channel, and the Theater District are areas where new residential development, achieved primarily through adaptive building re-use, is already occurring and is likely to accelerate in the coming decade.

The recent introduction of housing in the central business district has been privately financed and is contributing primarily to the supply of condominiums. Cost will be a determining factor in shaping the socio-economic character of

new residential neighborhoods; escalating interest and construction costs preclude a range of ownership opportunities. As planned commercial development projects materialize, the desirability of these areas for residential occupancy will be enhanced.

The stability of residential Chinatown is threatened by intense development pressures resulting from the construction of Lafayette Place, the renovation of the South Station area, the revitalization of the Leather District, Park Plaza development, and continuing expansion and development of Tufts University and Tufts-New England Medical Center. Through re-use of vacant manufacturing buildings, the decline of the garment industry could afford new opportunities to accommodate Chinatown residents' critical need for housing units. As in the central business district, financial considerations are primary. Development projects will need public assistance to make them affordable to the needy low- and moderate-income Chinese population.

The Chinese community extends beyond the borders of Chinatown. Many Chinese live in South Cove, and others are moving into housing on lower Washington Street and in the South End. Future development in the Theater and Leather Districts could accommodate the Chinese community's housing needs.

South Cove is divided into institutional and residential land uses primarily, with supportive residential services. Since 1970 approximately six hundred units of assisted housing have been constructed and are occupied primarily by Chinese residents. Only a few outstanding urban renewal parcels are available for development, and they could be developed for residential uses. Tufts University-New England Medical Center, located in the South Cove area, is planning major capital development projects to expand and improve the quality of education and medical services. However, this expansion might reduce the housing stock available for the Chinese community. Any further development programs proposed by Tufts must incorporate provisions for accommodating the residential needs of the community.

DEVELOPMENT ISSUES

What overall trends emerge regarding the existing housing stock and the past two decades of change? First, the supply of one- to four-family, owner-occupied housing has declined, and the desire for homeownership increasingly is being met through condominiums. Condominiums may satisfy the growing demand for smaller homes, which has resulted from decreasing household size and increasing energy costs. However, the cost of condominiums may be prohibitive for low- and moderate-income residents. Given current interest rates and inflated market values, only a very small segment of the population can afford the down payment and carrying costs associated with this type of homeownership. Hence, it appears that homeownership alternatives for moderate-income families have diminished.

Though the study area is expected to retain its rental character, the ratio of owner-occupied to rental units is shifting. In fact, the South End is the only area with a greater percentage of owner-occupied residential structures. During the next two decades, increases in the condominium supply will continue to alter the renter to owner housing mix in Central Boston.

Another housing trend which emerged during the past twenty years was an increase in the supply of subsidized dwellings. Changing economic forces rendered subsidized development a profitable venture, attracting large residential developers. Although each of Central Boston's neighborhoods experienced growth in their subsidized stock during the 1970s, the overwhelming majority of units were located in the Fenway and the South End (see map, Appendix B).

The number of market-rate rental housing units within the study area has declined since 1970. Low- and moderate-income households, especially those of the elderly, will be adversely affected if condominium conversions continue. Although displacement poses some hardship in any housing market, the low vacancy rate and high rent levels which typify the current market, further exacerbate the housing problems of less affluent groups.

The dynamics of development in Central Boston complicate attempts to maintain neighborhood stability and to improve housing options. Legitimate needs for jobs and revenue generated by commercial development, often conflict with equally legitimate needs for housing. Such is the case in some neighborhoods described previously, particularly in those, such as Chinatown, which abut Downtown. While commercial development may act as a catalyst for some residential development, development guidelines need to address how both residential and commercial projects will affect current neighborhood residents.

RECENT AND PROPOSED RESIDENTIAL DEVELOPMENT

In response to the increasing demand for housing in Boston, approximately fifty housing projects in Central Boston are in various stages of development. Table VI-5 describes them; Table VI-6 is a summary of residential development.

Approximately sixty percent of the projects are privately financed; the remainder anticipate or have received some form of subsidy. Cuts in federal housing subsidy programs jeopardize the future of some projects. Even if all those listed are actually constructed, two current trends are expected to continue in the next decade. First, the supply of subsidized housing for low-income groups will diminish, as demand continues to grow. Second, little housing is planned or under construction for people earning moderate incomes.

NOTES

1. 1970 and 1980 U.S. Census of Population and Housing.

2. Rolf Goetze, "Boston's Housing in the 1980s: Challenges and Opportunities", Boston Redevelopment Authority, September 1980, p. 51.

3. Bonnie Heudorfer, "Condominium Development in Boston", Boston Redevelopment Authority, September 1980, p. 28.

4. Fred C. Dolittle, George S. Masnick, Phillip L. Clay, Gregory A. Jackson, "Future Boston: Patterns and Perspectives:, The Joint Center for Urban Studies of MIT and Harvard University, 1982, p. 62.

5. Ibid., pp. 64-65.

6. Ibid., p. 65.

7. See Background Table 24.

8. Goetze, "Boston's Housing", p. 56.

9. Heudorfer, "Condominium Development", p. 28.

10. Karen Buglass, "Condominium Update: January through August 1980", Boston Redevelopment Authority, March 1981, p. 1.

11. Ibid., p. 1.

RESIDENTIAL TABLES

DESIGN

DESIGN AND DEVELOPMENT

INTRODUCTION

Central Boston is in the midst of an unprecedented building boom encompassing office, hotel, commercial and residential development which has the potential of changing the face of the City. As demand for new development sites and additional building space continues, questions are raised concerning how this new development will be accommodated and what its impact will be on the existing city fabric. Decisions will be made about how the City should be altered in terms of rehabilitation and demolition of existing buildings, air rights construction, changes to the city street network, filling of water bodies and adjustments to parkland. In order to facilitate development decisions affecting the design of the City, a full understanding of the issues is necessary.

For the past two decades of development Boston has displayed a commitment to urban design of high quality through the efforts of design-conscious citizens and professionals who have worked with city agencies and developers. Much of the past development in the City during this period was guided by the urban renewal process which afforded opportunities for substantial citizen involvement as well as very precise design controls for development parcels within project areas. Urban renewal is no longer a major force in Central Boston. Most new construction in the 80's will be initiated by the private sector without the benefit of detailed parcel by parcel controls. Urban design policy guidelines will provide the BRA, as the City's planning agency, with the framework to determine how much development should occur, what form it should take and where development should be located. Guidelines will enable the City to make informed evaluations and coordinated decisions about both public and private development proposals.

Urban design will be presented in this section in terms of four main objectives. A successful urban design policy will help continue producing a city that is attractive so that people feel it is worth coming to and being in; land uses will be arranged so that the City functions efficiently and is full of activity; the City will be easy to get to and move around in; and finally the City will be unique and convey a sense of continuity and history.

The impact and perception of city design varies significantly depending upon the viewer's relationship to the City. For example, the importance of Boston's skyline when viewed from across the river, is very different from the impact of building location, form and height upon the pedestrian within the City. The impact of development on urban design should be considered from all perspectives both within and outside the City, from various modes of travel -- rail, auto, airplane -- but the impact on the pedestrian within the City will be emphasized in this study.

Urban design will be discussed within four broad issue areas that are of major importance to the design of the City:

(1) urban form -- the interconnected patterns of circulation, open space, natural features, and building design that can produce a well-integrated, intelligible, humanely city;

(2) circulation -- the systems of pedestrian and vehicular movement, the conflicts between them, and the opportunities for mutual reinforcement of circulation and development;

(3) activity -- the combination of land uses that distinguish districts from one another and provide vitality; and

(4) conservation -- a sense of growth over time by retaining buildings, districts, and open space elements, and by assuring compatibility of the old and the new.

Discussions of policy issues will not emphasize questions of jurisdictional responsibility, overlap or fragmentation, procedural issues related to urban design controls and their implementation, or questions dealing with specific site design such as paving materials, tree species or lighting design.

As background to the discussion of urban design policy issues, the evolution of Boston's form and the effects of recent development will be presented. The traditional characteristics of the City as evidenced in its street pattern, building scale, open space system and land use as it evolved to 1950 will be contrasted to the changes that have occurred since that time.

EVOLUTION OF BOSTON'S FORM AND THE EFFECTS OF RECENT DEVELOPMENT

For 350 years central Boston has coped with the limitations of its topography with new schemes to enlarge or intensify its land use. Located on a small peninsula, Boston's physical shape has led to major alterations of that shape and increased building density. Its water boundaries, changed by so many filling operations over the centuries, still enclose and reinforce the character of the Downtown and its adjacent neighborhoods. The hills, once so prominent, are now gentle curves dominated from some vantage points by the large-scale silhouette of the office tower skyline.

Many of the physical elements considered essentially Bostonian still exist and are merged into the context of post World War II development. While the city's form has continuously changed and evolved over time, much of what is considered modern Boston, particularly in terms of highways and buildings, developed within the past three decades. This section identifies Boston's traditional characteristics of urban form and design and the changes produced since 1950. These characteristics will be discussed within the four general subject areas of street pattern and circulation, activity and land use, parks and open space, and cityscape and building scale. It concludes with examples of recent development, and their impact on the urban design of the City.

A. Street Pattern and Circulation

Streets can unify the pattern of the City by providing views and vistas, emphasizing topography and boundaries, providing open space, and of course making connections between areas of activity to accommodate movement. Historically, Boston's street pattern evolved in response to natural boundaries, topography, and functional needs. The narrow, winding streets and the burying grounds are the only remnants of 17th century Boston. Street names frequently identified locations and directions -- Battery March, Beach, Snowhill distinctions intriguing but uninformative to modern Bostonians.

During the 19th century as Boston grew to become a commercial center, more streets were created from earlier paths and alleys. The residential neighborhoods developed on more orderly grids -- loose grids like Beacon Hill and Bay Village and tight ones like Back Bay and the South End. Besides the continuous filling operations to make new land and streets, old roads were enlarged (Atlantic Avenue, laid out in 1868, cut through granite wharf buildings), were raised (Church Street was lifted 30 feet), and widened (in the business district immediately following the 1872 fire). The network of mid-block paths and alleys, Pi Alley and Spring Lane for example, provided pedestrian links.

Few major changes to this complex street pattern occurred until after World War II. Like most metropolitan areas, Boston's form has been dramatically altered by the needs of the automobile. Major expansion of the transportation system included: Storrow Drive, I-95 and I-93, Mystic-Tobin Bridge, Central Artery, Southeast Expressway, Callahan Tunnel and East Boston McClellan Highway, and the Massachusetts Turnpike Extension. The result is a large scale transportation system superimposed on Boston's traditional form. The elevated parts bisect neighborhoods and block views, while the depressed sections and broad surface-level sections cut swaths through the City degrading pedestrian access.

This system, along with local improvements, significantly increased the vehicular capacity of streets and highways to and within Central Boston and have provided access to major renewed Downtown areas -- Charles River Park, Prudential and Government Centers, and Quincy Market/Waterfront. Many of these projects obliterated the traditional streets within them. Street patterns in the West End and Scollay Square were eliminated by the superblocks of their subsequent development projects. The form taken by Government Center is more successfully integrated with the older surrounding street pattern than the cul-de-sacs of Charles River Park. The Waterfront project altered the existing city street pattern, most notably by relocating Atlantic Avenue. However, this strengthened connections with adjacent areas of the City by opening up waterfront views, providing pedestrian access to the harbor and establishing strong pedestrian links with the Downtown. To accommodate the expanded and more densely developed downtown and its vastly increased number of workers, visitors, and residents, the system of pedestrian spaces -- sidewalks, parks, and plazas -- has also grown both in number and quality. As a result of recent public and private development the pedestrian can walk on paths often paved with high quality materials, protected by arcades and canopies, and through landscaped open spaces that allow views of destinations, and provide a feeling of expansiveness, and awareness of natural features. Waterfront Park, Quincy Market, City Hall Plaza, Pemberton Square, and Downtown Crossing are a few examples of the best aspects of this system.

B. Activity and Land Use

Boston's physical evolution has always depended largely on the economic needs of the expanding City and planning efforts to meet these needs in an orderly, efficient manner. What are recognized today as activity centers -- Hanover Street, Faneuil Hall Markets, Downtown Crossing, the Financial District and the Back Bay all woven together with handsome and well-

established residential neighborhoods -- had all taken shape by the late 19th century. Later some rearrangement of activities occurred within these areas, usually larger portions of buildings were given over to commercial uses on streets like Charles, Salem, or Newbury. The subtle shifts within the Central Business District were a response to normal economic pressures. In sixty years, for example, the shoe and leather industry relocated successively in three neighboring areas before settling in the Leather District along South Street.

The traditional arrangement of activity centers remained relatively unchanged from 1900 to the 1950's. With the beginning of the Federal urban renewal program, and new local taxation techniques and zoning mechanisms, major new developments were publically planned and implemented. The old activity centers remained because of the connections to circulation and open space systems, but were planned to accommodate new buildings, streets, parks, and new or rearranged uses.

In addition to altering the physical appearance of the Downtown, these redeveloped activity areas have changed the patterns of interaction and functional relationships among various districts within Central Boston. These renewed activity centers include the Prudential Center, Government Center, Faneuil Hall Marketplace, the Downtown Waterfront and Charles River Park.

These rejuvenated centers have proved most successful when they contain round-the-clock activity, comfortable human scale, easy access, and connections to other centers via streets, open space, and transit. Some older places like the North End has housing, shopping, public facilities, open space, landmarks, views of the water, and a unique ethnic character. Some newer districts like the Faneuil Hall/Downtown Waterfront have been designed to incorporate these qualities. But others are less active like the Prudential which though it combines housing, shopping, office, and hotel uses, is disconnected from the street activity and scale.

In addition to these redeveloped centers of activity, major expansion of existing institutions also had a major impact on land use activity and relationships during the same period. The Christian Science Center, Tufts-New England Medical Center, Boston University, Northeastern University, Suffolk University, the Fenway hospital and school complexes, and Massachusetts General Hospital and Massachusetts Eye and Ear Infirmary have all changed the character of large parts of the City through physical expansion, often at the expense of residential uses.

What is recognized today as Central Boston has expanded in all directions to include the Waterfront, South Station and the Fort Point Channel area of industrial South Boston, the Charlestown Navy Yard, Huntington Avenue to the Fenway and medical schools, Kenmore Square, and the East Boston piers. Some of these areas provide opportunities for future development that can help to relieve intensive development pressures downtown. Copley Place, utilizing Massachusetts Turnpike air-rights, has the potential of reconnecting adjacent city neighborhoods, providing active edges along streets presently hostile to pedestrians, re-enclosing Copley Square and strengthening the Back Bay retail district. The Theatre District and North Station's Bulfinch Triangle, both undergoing conversions from warehouse or light industrial

uses, have the potential to preserve existing buildings and add new construction at appropriate moderate scale, or risk the loss of the architectural character of the area. In Fort Point Channel the architectural quality of some of the existing buildings lends itself to unusual rehabilitation opportunities, although most development will be through new construction on vacant sites and may increase pressure for demolition. How individual development projects or the collected efforts of developers in the emerging districts incorporate the failures and successes of their predecessors will bear most significantly on the adjacent sections of Boston.

C. Parks and Open Spaces

Boston's significant parkland and open space heritage includes both expansive, naturalistic landscapes -- ranging from the Common, Olmsted's Fens and Emerald Necklace, Eliot's Esplanade and Embankment, to Stoney Brook and Turtle Pond Reservations -- and the enclosed, urbane, planned green squares and malls such as Louisburg, Union, Monument Squares, and Commonwealth and Paul Revere Malls. Prior to World War I, any roads within parks were purely for the park visitor -- not the commuter. Access via foot to these parks was easy. Not surprisingly, Boston's waterfront until its commercial decline was utilitarian with little public access and little water-related recreation. Again it was Olmsted who planned downtown Boston's only harborside park in the North End prior to the 1970's.

With the post World War II construction of a modern large scale road system to accommodate increasing automobile pressure, some of Boston's parks were badly altered to improve vehicular access and reduce local traffic. Storrow Drive substantially reduced the size of the Embankment and Esplanade, and along with the Bowker Overpass at Charlesgate, complicated pedestrian access. The Under-Common Garage removed trees and altered the topography. Part of the Fenway became a paved parking lot.

Post 1960 development revived the original intentions of the Park Movement with new kings of urban open space. Christian Science Center Plaza, Copley Square, and City Hall Plaza are monumental paved plazas that provide dramatic settings for buildings offer a sense of spaciousness and vistas, and can be used as large scale gathering places. These open space resources provide opportunities for varied programs of activity such as concerts, lunch-time food vending, and community affairs. Small confined public spaces were also created, often with private contributions, such as Lincoln Filene, Boston Five Cents Savings, and Pembroke Street parks. These are significant additions to the 19th century network of small parks.

A major element of recent development in Central Boston has been public access and open space at the waterfront. A string of harborside parks has replaced the former utilitarian sheds and storehouses. From the Waterfront Park, one can meander over the granite wharves, connect with the North End playground and pool, and skirt the water's edge around the MDC ice rink and new Charlestown Bridge park and fishing pier. Despite its proximity, linkage to the next park, Paul Revere's Landing adjacent to the Charles River Dam, has not yet been implemented. The North Station development offers an opportunity to open the walkways across the Dam, and City Square roadway improvements could provide the necessary links to Paul Revere's Landing.

The nine acre Shipyard Park, beyond the National Park portion of the Charlestown Navy Yard terminates the harborfront park sites. These sites represent a phenomenal public resource produced in one decade and have had a decided impact on Boston's waterfront design. Fort Point Channel provides an opportunity to further extend the public harbor open space system through innovative design.

D. Cityscape and Building Scale

Few cities can boast of such a rich character and varied architecture as Boston. The commercial downtown has representative building types and architectural styles spanning about two centuries. Numerous buildings and streetfronts remain from the 19th and early 20th centuries. This architectural heritage expresses the evolution of commercial architecture as it responded to the economic needs, new technologies, and changing aesthetic fashion.

Located near the present Harbor is Federal Era Boston: this includes the small, four- and five-story brick rows often associated with Bulfinch's designs. Aside from the well-known Colonial and Revolutionary historical sites, these are Boston's earliest commercial structures. Interspersed are the later imposing granite warehouses built by merchants who found granite an appropriate expression of monumentality, stability, and longevity for their establishments. The massive 1872 fire destroyed most of the business district. While the overall scale of the reconstructed business district did not differ from the earlier granite era, the use of materials did. Elaborately decorated brick, granite, and cast iron were the chief materials used in the extensive post-fire rebuilding. Although often altered at the ground floor, these Victorian "commercial palaces" are much of what we know today as downtown Boston. Around the turn of the century appeared the elevator office buildings, eight to twelve stories, with highly decorated facades -- often in Classical or Beaux Arts styles and using light-colored masonry or occassionally red brick. Much of the Financial District is represented by these structures which display a uniformity of scale and setback. The new zoning regulations of the 1920's encouraged massing of the large-scale buildings by roofline setbacks. These new wedding cake towers provided a new element in Boston's skyline.

Twenty years ago Boston was moribound. Little major new development had been undertaken for 30 years. The tallest building on the skyline was the Custom House Tower. Since the early 1960's the development picture has changed dramatically. At first a massive planning effort with Federal urban renewal assistance starting with the Government Center project was necessary to reverse the pattern of stagnation and decline. Even private commercial development required the subsidies of land cost write-downs to overcome the resistance to investment. Investment in Central Boston caught on and proved to be profitable. The next two decades saw dramatic increases in private investment and the construction of new and rehabilitated commercial space in retail, office, hotel, and residential use.

Many residential neighborhoods in Central Boston have been preserved largely intact with few post-War intrusions. These neighborhoods exhibit a wide range of architectural styles including the 19th century Federal and Greek Revival buildings of Beacon Hill and Charlestown, the later Victorian buildings

in the South End and Back Bay, and the Classically inspired apartment blocks and tenements of the Fenway and North End. Most development in these neighborhoods during the past three decades has involved rehabilitation of existing structures. Many infill buildings in these areas have been sensitively designed to relate to the surroundings. Examples include the Knoll Building and Exeter Towers in the Back Bay, the Hancock Street Apartments on Beacon Hill, and the Ansonia Elderly Housing in the North End/Waterfront.

The change in the Boston skyline is the most striking and obvious impact of development during the past three decades. Once dominated by the Custom House Tower in the Financial District and the Old Hancock Building in the Back Bay, the skyline now shows a dense cluster of corporate and government office towers in and around the Financial District, residential towers on the Waterfront and at Charles River Park, and office and institutional towers in the Back Bay. The new skyline indicates the resurgence of Boston as a vital regional center of economic growth and activity and of investor confidence. The new colors and textures illustrate the changes in building technology from the use of masonry materials to glass and metal. Though the tall buildings raise many questions to be discussed later in this report, they serve the purpose of orientation, function as landmarks, and provide views of the City and its environs.

The sense of human scale is communicated in the treatment of the smaller parts of a building or project as well as in the overall height and bulk characteristics. Often buildings otherwise appropriate in scale fail to reinforce the scale of human activity at street level by employing details -- wall elements, window openings, entry spaces -- that are "larger than life", for example, the Shawmut Bank. In some cases, buildings that are very large can be made more human through careful detailing -- the arcade and plaza treatment of the New England Merchants Bank. In housing especially the elements of human scale are important to emphasize -- doorways, courtyards, front steps, window details. But even in large office towers the handling of facade materials can make the difference between a building that seems to relate well to human scale as in the Hancock Tower in contrast to the Prudential tower where the materials create nothing more than an abstract pattern that gives no clue as to how it is related to human size. The earliest towers had unprecedented panoramic views of the region. An impact of the additional clustering of towers has been the loss of some of these views. From the opposite perspective, views of Park Street Church steeple from Columbus Avenue and of the Old North Church from Tremont Street were protected by the planning of earlier development projects. Landmarks like historic churches and public buildings, and towers such as the Hancock Tower and the cluster of downtown skyscrapers help to locate and define areas of the City. Views of these landmarks contribute significantly to one's sense of orientation.

The new buildings have a dramatic impact on the urban environment. Boston is fortunate in that many new structures are of landmark quality: the New City Hall by Kallman and McKinnell, the new Hancock Tower by I.M. Pei, the Boston University Law and Education Tower by Josep Luis Sert, Paul Rudolph's State Services Building, and Edward Larrabee Barnes' New England Merchants Bank. The City has some outstanding examples of building reuse and rehabilitation -- Old City Hall by Anderson-Notter and Winthrop Square Building by CBT, to mention a couple. These buildings and projects have set the tone

and established a high standard against which the City can measure new development proposals. However, several large redeveloped areas such as Charles River Park and the Prudential Center suffer from both poor site and building design. In some instances, individual structures constructed in recent years relate less successfully to their surroundings than the buildings they replaced, for example the new Jordan Marsh store on Washington Street.

1. New Construction

a. Height and Massing

The increase in height of Downtown development from 150 feet in the past generation to 500 feet can hardly go unnoticed. The Shawmut Bank, State Street Bank, and the proposed 53 State Street blend their height successfully into the fabric by emphasizing elements of commonality with neighboring buildings like related cornice heights at the old scale and continuity of treatment at street level. Other buildings make abrupt changes in scale and setback -- First National Bank, Blue Cross-Blue Shield, One Beacon Street, and the Boston Company Building. In some cases though, high-rise construction can be handled so skillfully that the results do not intrude on the scale of the surroundings as in the case of the Hancock Tower. Buildings that are too short can also have a decided negative effect on Boston's form. Where relative uniform height exists along several blocks, the stunted building, like the newest Filenes and Jordan Marsh stores or Union Warren Bank at Arch and Summer, is out of scale as the tower form.

Less obvious than the impact of very tall buildings is the impact of mismatches in scale created by excessive bulk or massing when new development fails to fit its context. When well-handled as in the case of One, Two and Three Center Plaza, the masssing of new development helps to define adjacent spaces -- Pemberton Square and City Hall Plaza -- while providing a building form that people can easily relate to. Other examples of complementary massing include the new Transportation Building at Park Square, the Park Street Church addition, Charlestown Savings Bank, housing at Waterfront Park, and the Five Cents Savings Bank. When handled less well, adjacent spaces are ill-defined, inhospitable spaces left at the street due to peculiar setbacks, access and entry obscured, and the relation between the size of buildings and the size of people is difficult to grasp, as is the case of the new Federal Reserve Bank, One Beacon Street, Prudential Center at Boylston Street, and the First National Bank.

Other new development has been of moderate height -- the new Ritz-Carlton, 50 Milk Street, Provident and Five Cents Savings Banks. These and other buildings improve the fabric of the City by filling in the holes left by demolition. The Ritz addition and One Washington Mall are models of new construction coordinating height and massing elements with the adjacent landmarks, the Ritz-Carlton and the Ames Building. Small scale new construction has often been associated with renewal projects -- Government Center has numerous examples -- but Union and Central Wharves indicate that limited height can be economically achieved.

As in previous periods of rapid building and economic growth, construction has dramatically altered some of Boston's traditional characteristics. In many cases, architecturally important structures were demolished as small buildings on small lots were consolidated into large development parcels. Sometimes clearance of single buildings within blocks has created visual gaps in the streetscape that remain vacant for years. These characteristics relate to the impact during the past fifteen years that new development has on land values and hence on the economic feasibility of further development. While the Zoning Code limits building density to ten times the lot area as a maximum, almost all new development has been built under variances to the Code permitting density in excess of the maximum. In expectation of variances, the value of downtown land has risen in a spiraling process that demands ever greater density to rationalize higher land costs which in turn encourage still higher land values.

The assessing practices also affect this phenomenon: undeveloped vacant land, is underassessed and consequently taxed lower than buildings. As a result, there is an advantage to speculatively held vacant land rather than buildings over a period of time in anticipation of a dramatic increase in value. In many instances older structures of architectural merit are purchased speculatively, poorly maintained or demolished, and the land held until values reach the owner's expectations. This combination of zoning variances and assessing practices may be creating pressures that run counter to desires for moderate density and scale.

The change in building materials is also one of the more striking impacts of new development on the Downtown during the past thirty years. Where red brick, limestone, and granite predominated in earlier buildings, new development at the West End, Government Center, Prudential Center, Christian Science Center, and in the Financial District introduced not only larger building forms but also materials such as precast and poured concrete, large expanses of glass, and metals like steel and aluminum. The loss of human scale in these developments is the result of the way the building materials are used.

b. Public Art

Boston's cityscape has been enhanced by a long tradition of fine art in public palces -- gravestone art in the 18th century burial grounds, portraits in Faneuil Hall, statuary in the Common, Public Gardens, Commonwealth Avenue Mall, and Charles River Esplande in the 19th century, and more recently a widening of the scope of public art in the form, for example, of wall panels at Quincy School based on children's art by Maria Termini, the mural on the gas storage tank by Corita Kent and on an MBTA elevated structure by Karen Moss, abstract sculpture at Temple Israel by Louise Nevelson and at Government Center Garage by Beverly Pepper, the Black power murals of the late 1960's on South End buildings, the mosaics at Park Street Station by Carol Rosenberg, the witty and sympathetic

image of Mayor Curley at Dock Square, Mags Harries' brillant sidewalk bronzes at the North End produce markets and Richard Haas' trompe d'oeile mural at the Boston Architectural Center.

Development guidelines under urban renewal required that 1% of project budgets be devoted to the purchase of fine art accessible to the public. Many of the examples of public art in the 1960's and 1970's are a result of the 1% program.

2. Conservation

Throughout Central Boston preservation and rehabilitation of single landmark structures or entire blocks is commonplace, and profitable. Preservation development is exemplified at St. Germaine Street, Charlestown Navy Yard, Faneuil Hall Marketplace, along Fulton and Commercial Streets, and Milk Street. Partly as a reaction to the large scale towers and the loss of older, familiar buildings, Bostonians are concerned about retaining their City's characteristic appearance. Not surprisingly, both new development and preservation development is being encouraged to enhance surrounding areas by relating new and rehabilitated buildings, materials, massing, and building details such as cornice lines and setbacks with adajacent structures.

Boston is recognized nationally for its preservation and recycling efforts. The number of rehabilitated structures matches new construction projects during recent years. From meticulous restoration, such as the Ebenezer Hancock House, to general upgrading represented by the Chadwick Lead Works or Russia Wharf, to rehabilitation combined with new construction as in the Vendome or the McLaughlin Elevator Company, the list is extensive.

One dramatic impact on Boston's character has been in the areas where sensitive new development has blended with the old -- such as on the Waterfront. Choosing appropriate building sites, conservation of the majority of notable historical buildings and streetscapes, and creation of open spaces show the positive impact of new development.

The primary impact of recent Downtown redevelopment and the simultaneous renewed interest in living in Central Boston ranges from owner-occupant's general "cosmetic fix-up" to complete rehabilitation. Conversion of surplus public or institutional buildings to housing is an important facet of rehabilitation in the neighborhoods. Common to most of these renovations is the preservation of the structure's important architectural features. The collective result is the retention of the City's physical and architectural characteristics which make it a desirable place to live.

E. Examples of Recent Development Impact

Several development projects illustrate the monumental changes to a few of the City's activity areas during the past several decades and the related impacts to adjacent areas in terms of street pattern and circulation, activity and land use, parks and open space and cityscape and building scale.

1. Prudential Center

Developed in the early 1960's, Prudential was the first major hotel-office construction in Boston in 30 years. Constructed on a 31 acre site formerly housing a railroad yard and the Mechanics Hall Exhibition Center, the Prudential Center represents an attempt to mix several uses on a single site. It includes 1,700,000 square feet of office space in two towers, 781 apartments in three high rise structures, a 1,400 room convention hotel, the 5,800 seat Hynes Auditorium and exhibition center, 400,000 square feet of retail space and a 2,900 car parking garage. This development is often credited with increasing investor confidence in the City and stimulating additional private investment both in the Back Bay and elsewhere downtown. The Christian Science Center, rehabilitated St. Botolph neighborhood and healthy Back Bay retail-residential neighborhood would tend to support this conclusion. In addition to strengthening the Back Bay retail district with two major fashion department stores -- Saks Fifth Avenue and Lord and Taylor -- the Prudential Center also provided badly needed convention facilities, hotel and office space.

Prudential, however, represents a drastic change of scale in the Back Bay that fails to relate to the neighborhood. The office tower on its raised podium makes no gestures towards blending with the pre-existing scale. The retail component is separated from the continuity of retail activity on Boylston Street both by changing direction from the street and by its elevation above the street. Its failure to reinforce the pattern of use along the street may account for the lack of upgrading of Boylston Street retailing and the predominance of fast-food and drinking establishments. The open space at Prudential suffers from shadow, high winds, and the absence of activity because of its monumental scale and unattractive appearance.

2. Government Center

While the Prudential Center is an example of a major new activity center developed by the private sector on land largely undeveloped, Government Center was developed through the urban renewal process and required the clearance of approximatley 60 acres, the elimination of streets and realignment and widening of the remaining streets. Government Center replaced Scollay Square, famous for its concentration of entertainment uses with more sedate 9 to 5 office activities and physically transformed its central location with the monumental new City Hall and its 9 acre brick plaza. Government Center represented an increase in scale and density from the development that preceded it but unlike the Prudential Center, was integrated into the City's fabric with its system of pedestrian ways, open space and street network. While the intensity of activity, in terms of daytime office use, increased in Government Center as a result of its redevelopment, nighttime activity decreased substantially because of its largely single function nature (offices for private and public concerns). Attempts were made to enliven the major pedestrian edges around City Hall Plaza through the introduction of grade level retail and restaurant uses, but the Plaza is often devoid of activity during the evening hours.

The careful review of the design of buildings and plazas in relation to the master plan by I.M. Pei produced a coherent and integrated overall design that conveys an image and sense of identity representative of the renewal of the Downtown. It incorporates significant views and vistas -- Old North Church -- and individual buildings of high quality at varying heights and configurations, all of which enhance the scale of the area and its surroundings.

3. Downtown Waterfront

The redeveloped waterfront created a new residential retail/entertainment area through both rehabilitation of historic structures and new construction. Approximately 1,600 units of housing were created, establishing a sizeable residential neighborhood where decaying fish piers and produce warehouses previously stood. Commercial retail uses, primarily boutiques and restaurants, are inter-mixed on the lower floors of residential buildings, continuing the tradition of the adjacent North End. A notable exception to the low rise nature of the Waterfront is the Harbor Towers development which obstructs waterfront views from the downtown area and interrupts pedestrian access along the Waterfront. But the project succeeds in introducing lively, round-the-clock activity, major park space, views of and direct contact with the Harbor, water-oriented uses like the New England Aquarium, boating clubs and better access to passenger vessels.

POLICY ISSUES

If current demand continues, over ten million square feet of office space alone would be produced as new or rehabilitated construction during the next decade. The equivalent of ten additional office towers the size of 60 State Street would be required to meet this demand and together with other development would produce a dramatic change in the function and appearance of the downtown. This development opportunity along with many others presents challenges and raises many questions that are considered in this section under the same general topic headings discussed in the preceding section: (1) urban form and new development -- in what ways should new projects complement and enhance the best aspects of the existing City pattern; (2) circulation -- how should circulation systems respond to new demands; (3) activity -- what uses are appropriate to various locations; and (4) conservation -- how should the new and the old be integrated so that each benefits?

A. URBAN FORM AND NEW DEVELOPMENT

Boston's urban form, its three-dimensional pattern composed of water boundaries, hills, open space, streets, and structures, contributes significantly to our appreciation of the City's distinct character and feeling. It gives us a sense of living with the environment by helping us to find our way, reach our destinations, and understand the logic in the relationships among the parts of the City. Public improvements and private development should be evaluated in terms of urban form so that these activities can enhance the pattern and thereby improve the image of the City.

Much of what is most appealing about Boston derives from its European character, its ethnically and architecturally diverse and well-defined districts, and its moderate scale. Unlike all but a few American cities Boston retains a charm and desirability produced by its relatively small scale. Boston does not yet have the homogeneous facelessness that robs so many other cities of any sense of unique character. As development of the downtown continues the threat of losing this character increases, and the result could be a city that is no longer as desirable both to its citizens and also as a development market; as Boston grows it could become less attractive as a place for investment in growth both social and financial. IS THERE ROOM FOR GROWTH IN WAYS THAT PRESERVE AND ENHANCE WHAT IS UNIQUELY BOSTONIAN?

Historically monumental scale was reserved for buildings with the greatest public significance -- Bulfinch's golden-domed State House, the Custom House Tower, the City Halls both old and new -- expressing the City's highest aspirations. But throughout its history the economics of real estate development have become a major factor influencing the character and scale of new development. The public is often faced with the trade-off between development projects which are disruptive to existing scale characteristics or no development at all. The challenge is to find the solution which permits the benefits of new development without degrading the environmental context.

Boston's charm and appeal are a result of a history of dedication to the goals of good architectural and urban design. Both public and private development have contributed to the overall sense of quality and concern for the environment. As costs of land, labor, materials, and money spiral upwards, however, a conflict arises between what is attractive and desirable, and what is economically feasible. Is Boston prepared to reject development proposals on the basis of poor design quality and forego the benefits of investment and tax revenue, jobs, and additional urban activity? Can the design of proposals be improved through the efforts of professionals working on behalf of the public with the support of public officials? At this stage in the redevelopment of the downtown can Boston afford to pick and choose in order to get the best?

To be successful new development must fit into its context in terms of activity, height, bulk, and overall appearance. Since different areas of the City have different characteristic heights, bulk, and appearance, these qualities of new development are relative. Futhermore tall buildings as a necessary and expressive building form can have either positive or negative effects on the City pattern and environment. When properly located tall buildings can enhance topographic form, existing skyline, and one's sense of orientation and destination. Tall buildings also can be appropriate in defining the location of centers of activity. Appropriate locations for various types of development, integration of new development into the existing City fabric, and open space development are all issues which must be addressed in the future.

1. <u>New Development Sites</u>

HOW CAN NEW DEVELOPMENT BE DIRECTED TO AREAS THAT NEED THE STIMULUS OF INVESTMENT INSTEAD OF TO AREAS THAT ARE ALREADY WELL-ESTABLISHED AND ARE THREATENED WITH OVER-BUILDING? State Street and the Financial District have been intensively developed, while substantial portions of the Downtown -- North Station,

South Station, and the Fort Point Channel area -- have attracted
interest. In some cases the reasons for the lack of interest are a
For example, access to the Fort Point Channel and industrial Soutl
Boston is very poor, and a major investment in public infrastructu
needed to stimulate investment. In North Station, which enjoys ex
access and close proximity to Government Center and Quincy Marke
reasons are vague. Investment in one portion of the City does see
attract additional investment, and at North Station the proposed Fe
Office Building is likely to reverse the pattern. The development w
follows is likely to be a concentration of mutually supportive buildin
and land uses.

The City is providing "subsidies" in the form of tax agreements and/
zoning variances in order to encourage new development. SHOULD T
CITY USE THESE "SUBSIDIES" TO DIRECT DEVELOPMENT AWAY FR
THE FINANCIAL DISTRICT AND INTO ADJACENT AREAS? Many peo
feel that the proliferation of downtown office towers is degrading the
environment by creating very windy corners, depriving public spaces
sunlight, causing streets to become shadowed canyons, and causing th
loss of structures of historic and architectural merit.

2. Integration of New Development

a. Bulding Height

Tall buildings are a logical and necessary response to the realities
of real estate economics and available technology. They can help
identify centers of activity and serve as landmarks for orientation.
They offer a perspective of the City that emphasizes the relationshi
of its physical elements, it delicacy, its fragility, and the limitations
on its growth imposed by its physical boundaries. The pattern of
tall buildings creates a skyline which we acknowledge as a symbol
of urban life and activity. But at the same time tall buildings can
often produce abrupt interruptions in the prevailing scale of an
area, create wind problems, degrade the environment of public
spaces with their shadows, and in clusters rob streets of sunlight
and fresh air, and produce congestion on our streets, and sidewalks.
HOW CAN THE CITY MAINTAIN THE TRADITIONAL MODERATE
SCALE AND COMPATIBLE USES OF DOWNTOWN AREAS AMIDST
RISING PROPERTY VALUES AND THE DESIRE FOR MORE INTENSIVE
DEVELOPMENT? SHOULD BOSTON DISCOURAGE THE DEVELOPMENT
OF MORE TALL BUILDINGS? ARE THERE AREAS WHERE TALL
BUILDINGS CAN HAVE A BENEFICIAL IMPACT ON URBAN FORM,
EMPHASIZING TOPOGRAPHICAL FEATURES OR ACTIVITY CENTERS,
ENHANCING THE SKYLINE, AND STIMULATING FURTHER DEVELOP-
MENT ACTIVITY? SHOULD CERTAIN LOCATIONS BE CONSIDERED
OFF-LIMITS FOR TALL BUILDINGS SO AS TO PRESERVE THE
QUALITY AND SCALE OF NEARBY PUBLIC OPEN SPACES OR
LANDMARK BUILDINGS AND DISTRICTS? Can tall buildings be
designed to avoid uncomfortable changes in human scale by empha-
sizing their similarities to existing building, for example by setting
back the towers from street lines, creating elements of transitional

height between the tower and the existing buildings, providing base elements with cornice heights similar to surrounding structures, or elements at lower levels like entrances, storefronts, and window openings which are at the same scale as their surroundings?

Building bulk, the apparent massiveness of a building compared with its surroundings, raises issues similar to the building height issues. Large floor areas are often seen as the most efficient use of space, and the problem of combining different uses with different structural requirements like long-span ballrooms and short-span hotel rooms can produce bulky building forms. Bulk is, like height, a relative issue: a twenty-story building in the residential Back Bay is very tall but in the Financial District is modest. Bulk similarly depends on how much wall area is visible and how far above its surroundings it extends. Large forms of unusual shape can also create problems. SHOULD IMPORTANT VIEWS OF THE WATER OR OF SIGNIFICANT LANDMARKS BE CONSIDERED IN THE LOCATION OF TALL AND BULKY BUILDINGS? SHOULD BULKY BUILDINGS BE LIMITED IN HEIGHT TO THAT OF THE SURROUNDING BUILDINGS? SHOULD LARGE UNUSUALLY SHAPED BUILDINGS BE ALLOWED? CAN THE APPARENT MASS OF A BUILDING BE MODIFIED EFFECTIVELY BY SURFACE TREATMENT AND DETAILING? CAN THE STREET LEVEL IMPACT OF MASSIVE BUILDINGS BE MADE ACCEPTABLE THROUGH STRONG RELATIONSHIPS OF USE, DETAIL, MATERIALS TO OTHER NEARBY BUILDINGS OF MORE HUMAN SCALE?

b. Materials and Detailing

The question of what constitutes an appropriate building material is related to both where a building is and what surrounds it. For instance, how appropriate is the use of blue glazed brick? Perhpas the question relates more to how a material is used rather than what material is used. For example, the attractive use of pre-cast in the State Street Bank Building as contrasted with the less successful use of the same material in One Beacon Street office tower. The choice of appropriate materials and detailing for the ground floor and first few floors above is especially important. The choice of materials used in the surface treatment of surrounding plazas and site features is as important as the building itself. SHOULD NEW CONSTRUCTION BE MADE TO BLEND INTO ITS SURROUNDINGS THROUGH THE USE OF SIMILAR BUILDING MATERIALS? WHEN IS THE USE OF CONTRASTING MATERIALS APPROPRIATE?

c. Image

CAN THE DESIRE OF CORPORATE DEVELOPMENTS FOR A UNIQUE PHYSICAL IDENTITY AND CORPORATE IMAGE BE INTEGRATED WITH THE DESIRE TO MAINTAIN AN ORGANIZED AND COHERENT CITYSCAPE? In too many examples in Boston and other cities new development has tried to separate itself physically from the fabric of the City in order to create a separate image. Barren plazas at One Beacon, Prudential, and the new Federal Reserve Bank, towers

that fail to acknowledge and respect the scale of the surrounding area, abrupt changes in use, like discontinuity in retail use along a shopping street to create a single-use lobby area for an office building, all are the product of the desire for a distinct identity. What methods can promote an attitude that favors better integration of new development with the existing fabric?

d. Public Art

Boston's long tradition of enhancement of the cityscape through the use of public art was complemented by the 1% fine art requirement of the urban renewal program. Now that the economic incentives of the urban renewal program are no longer available to developers CAN THE CITY CONTINUE TO REQUIRE PUBLIC ART IN PRIVATELY FINANCED PROJECTS? WITH FUNDS FOR PUBLIC IMPROVEMENTS SEVERELY LIMITED BY PROPOSITION 2½, SHOULD THE CITY CONTINUE TO INCLUDE ART IN PUBLIC PROJECTS? WHAT CRITERIA SHOULD BE USED TO DETERMINE THE LOCATIONS WHERE PUBLIC ART WILL HAVE THE GREATEST BENEFICIAL IMPACT? CAN MECHANISMS BE ESTABLISHED FOR FUNDING ART THROUGH JOINT PUBLIC AND PRIVATE EFFORTS? WHAT METHODS SHOULD BE USED TO SELECT ART AND ARTISTS?

3. Open Space

Parks, plazas, and other open space elements -- Louisburg Square, City Hall Plaza, Waterfront Park, Washington Street Mall -- are some of Boston's most distinctive and valued urban design elements. They enrich the color and texture of the urban pattern, provide a sense of relief from the more built-up and congested sections, and offer opportunities for passive or active recreation. In some instances, however, the open space is lost, disconnected from pedestrian flow and street level activity, lacking in interest and vitality. Some open spaces lack clear definition and distinct boundaries. Those which are surrounded by buildings of uniform height and mass seem more contained and peaceful. Others are badly affected by wind and shadow. Some are raised above or sunken below street level and feel uncomfortable and unsafe.

How can private development projects reinforce and enhance public open space and other public amenities? Open space is always more useful and attractive when it is part of an integrated system -- a series of spaces connected by landscaped streets or pedestrian ways. Planning the open spaces as a system is a long-standing tradition in Boston dating back to the Frederick Law Olmsted "Emerald Necklace" plan which saw the Common and Garden and Franklin Park as the jewels and Commonwealth Avenue Mall and the Back Bay Fens as the connecting thread. In more recent development projects -- new Federal Reserve, Prudential, and First National Bank, for example -- open space as park or plaza is seen more as a setting to enhance a building. This attitude tends to isolate the buildings and produces spaces that lack activity because they are disconnected from the system. Waterfront Park, Quincy Market, City Hall Plaza, Washington Mall, Five Cents Savings Bank Park, Filene's Park, and the Downtown Crossing, on the other hand, reinforce each other

and promote more interesting activity and more vitality. Integration with the existing system can produce benefits for new development in the form of higher rent levels at grade-related floor levels for retail use. HOW CAN PRIVATELY DEVELOPED OPEN SPACE REINFORCE THE PUBLIC OPEN SPACE SYTEM? WHAT TYPES OF PUBLIC OPEN SPACE SHOULD BE ENCOURAGED AND WHERE SHOULD THEY BE LOCATED?

B. CIRCULATION

Transportation has always been essential to urban growth and development and has clearly affected the form of Boston. Since World War II, especially, the City has been dramatically shaped by the automobile and has felt its impact in street congestion, pedestrian conflict, parking problems, air and noise pollution, and an inadequate public transportation system. Until the 1970's, the major improvements to Boston's transportation system have been to streets and expressways, while far fewer improvements have been made to the MBTA, commuter rail services, and specialized systems such as commuter boat service in 1972. As decisions continue to be made regarding new development in the City, questions need to be addressed regarding the need for increased access and how it is achieved, the relationship of streets and the public transportation system to the urban fabric, the pedestrian/automobile conflict and the overall design quality of the entire transportation network.

1. Streets and Pedestrians

A basic circulation issue is the conflict that exists in many Central Boston locations between pedestrians and vehicles. Since pedestrians and cars are usually forced to share the same right-of-way, narrow sidewalks, parking entrances across sidewalks and intersections cause the greatest conflict. Many conflicts can be reduced through simple solutions such as lane markings or neckdowns. Other solutions, such as widening sidewalks as in the reconstruction of Columbus Avenue and Tremont Street, may require a sacrifice vehicular capacity to accommodate the prime user of downtown streets, the pedestrian. Another alternative is to close streets completely to vehicular traffic. SHOULD THE CITY PROMOTE FURTHER PEDESTRIANIZATION AS AT FANEUIL HALL MARKETS AND DOWNTOWN CROSSING TO ALLEVIATE THE CONFLICT?

The existing network of alleys, passageways, and interior building corridors and lobbys is a valuable resource heavily utilized by the pedestrians in Central Boston. UNDER EHAT CIRCUMSTANCES DO OPPORTUNITIES EXIST FOR PEDESTRIAN CONNECTIONS BELOW GRADE AND AT SECOND LEVEL? SHOULD THE CITY REINFORCE THIS INFORMAL PEDESTRIAN SYSTEM, REQUIRING PRESERVATION OF THROUGH-BLOCK PEDESTRIAN ROUTES AND PROVISION OF MISSING LINKS IN NEW DEVELOPMENT PROJECTS?

2. Access

WHAT TYPES OF IMPROVEMENTS TO THE CITY'S ROAD SYSTEM SHOULD BE PERMITTED TO ACCOMMODATE NEW DEVELOPMENT? CAN HIGHWAY IMPROVEMENTS BE DESIGNED TO INCREASE VEHICULAR ACCESS WITHOUT DESTROYING THE CITY'S HISTORIC STREET PATTERN OR

DETERIORATING THE PEDESTRIAN ENVIRONMENT? During the past thirty years, major new highways and streets and the widening of existing streets have significantly increased vehicular capacity to and within the downtown. Construction of both Government Center and the West End resulted in the loss of many existing streets over large areas of the City, the creation of large, pedestrian-oriented spaces, and large new and widened streets such as Congress and Cambridge. Continued development, such as in the Fort Point Channel area and elsewhere, may require further new roadways. However, in comparison to other major cities, downtown Boston's street system is still archaic and inefficient in terms of capacity. Evolving over the years, the streets, particularly in the downtown, are characterized by varying street widths, discontinuities, and awkward alignments and intersections. Yet, at the same time, Boston's street system contributes significantly to the City's form and human scale. Will proposals such as the Leverett Circle/I-93 connector and the Third Harbor Tunnel contribute to the destruction of this character?

HOW SHOULD INCREASING DEMANDS FOR AUTOMOBILE PARKING BE ACCOMMODATED? While some sections of the downtown are adequately served by off-street parking, Beacon Hill, Back Bay and the North End are not. In those areas visitor and commuter parking competes with residential needs. New development increases the demand for both on-street and off-street parking, and raises the question of how this parking should be accommodated. Parking options can include various types of structures both above and below grade, in single use or multi-use structures or off-street surface parking lots. Each alternative has its design impact. The parking freeze requires that new commercia parking spaces have an equivalent number of obsolete spaces retired.

CAN THE EXISTING TRUCK DELIVERY AND SERVICE SYSTEM BE IMPROVED TO MINIMIZE THE CONFLICTS WITH PEDESTRIANS AND VEHICULAR TRAFFIC IN CENTRAL BOSTON? While most new development includes provisions for adequate loading facilities within the structure, conflicts still occur in servicing existing buildings and truck traffic is overly dominant in the downtown area during daytime hours. Can steps such as improved off-street loading and control of hours be taken to reduce the negative impacts?

3. Relationship to Urban Fabric

HOW CAN THE NEGATIVE IMPACT OF EXISTING HIGHWAYS WHICH ARE REAL BARRIERS BE REDUCED? The construction of major highways in the City have often sliced through historic neighborhoods and dramatically altered the urban environment. The green girders of the Central Artery create a wall which effectively isolates the North End community and separates the downtown from the waterfront. Storrow Drive isolates residential Back Bay and Beacon Hill from the open space resources of the Esplanade and Charles River Basin, and the Massachusetts Turnpike separates the Back Bay from the South End community. Some attempts to improve the Massachusetts Turnpike's negative impacts have been successful, including construction of the Prudential Center and Copley Place on air-rights over the roadway itself. SHOULD THE CITY FURTHER SUPPORT EFFORTS TO MITIGATE THE EFFECTS OF THESE HIGHWAYS SUCH AS THE PROPOSED DEPRESSION OF THE CENTRAL ARTERY?

WHAT CHANGES ARE NEEDED TO IMPROVE THE APPEARANCE OF EXISTING STREETS FOR BOTH PEDESTRIANS AND DRIVERS? WHERE ARE THEY NEEDED MOST? The City's responsibility in this regard is important because the circulation system can be made more legible and functional through municipal programs of street lighting, paving, landscaping, and amenities. The pedestrian environment of many downtown streets is dependent upon a number of factors. Information systems, the quality of public and private signs, location and design of street furniture, and the extent of landscaping all contribute to a pleasant pedestrian environment and give importance to streets. Haphazard placement and design of street furniture such as street lights, signs and utility boxes have unnecessarily cluttered the streetscape, often disorienting both pedestrians and drivers.

4. Public Transportation

HOW CAN TRANSIT IMPROVEMENTS AND STATION LOCATIONS BE INTEGRATED WITH ADJACENT, EXISTING AND PROPOSED NEW DEVELOPMENT? HOW SHOULD NEW STATION LOCATIONS BE DETERMINED? New development in the downtown must be located where streets, mass transit and truck access capacity are sufficient to accommodate the increased use. New development such as Copley Place and the planned redevelopment of North Station provide opportunities to improve transit efficiency with line improvements (removal of Green Line elevated) and improve access between transit stations and surrounding activities.

SHOULD THE WATERWAYS BE UTILIZED TO PROVIDE INCREASED ACCESS TO CENTRAL BOSTON? HOW SHOULD WATER RELATED TRANSPORTATION FACILITIES BE INTEGRATED WITH WATERFRONT DEVELOPMENT? Given the demands on the transportation system that now exist, it is evident that all available facilities must be improved and new approaches examined. Possibilities for waterborne travel include major links between the downtown waterfront, East Boston and the airport, residential and commercial South Boston as well as other shore communities. The downtown core and waterfront remain a strong center and the focus of much travel in the region. DO PLANS FOR THE REDEVELOPED WATERFRONT OF CENTRAL BOSTON INCLUDE ADEQUATE PROVISIONS FOR WATER DEPENDENT TRANSPORTATION?

C. ACTIVITY AND LAND USE

Central Boston consists of a complex mixture of interrelated land uses which has changed over time and will continue to change in response to market demand and public policy. These land uses generate different levels of activity at different times of the day, have different space and service requirements, and in many instances are competing for the same limited supply of land and buildings. As demand for additional building space continues for office, institutional and residential uses, basic issues are raised concerning where and how expanded uses should be interrelated, if certain uses should be allowed to predominate in particular sections of Central Boston and what public improvements are necessary to encourage desired levels of activity.

1. Activity Levels and Mixed Use

IN WHAT AREAS OF CENTRAL BOSTON SHOULD INTENSIVE ACTIVITY BE PROMOTED? CONVERSELY ARE THERE SECTIONS OF CENTRAL BOSTON WHERE INTENSIVE ACTIVITY SHOULD BE DISCOURAGED? Activity levels in terms of pedestrians and vehicles generated differ in various parts of Ccentral Boston at different times of the day depending on the particular combination of land uses present. The degree to which the physical form of the City facilitates activity, interaction and opportunities to meet people is often considered a measure of its success. Round-the-clock activity is generally a goal of land use arrangement in the Central Business District. Quincy Market with its mixture of commercial uses integrated with open space amenities is an example of a recent development that generates activity throughout day and evening hours. However, in the residential sections of Central Boston, such as Back Bay, Beacon Hill and the South End, and those commercial and industrial areas adjacent to them, round-the-clock activity, particularly uses that generate activity late at night such as bars and restaurants, are generally considered detrimental to neighborhood quality. What activity levels are appropriate for various districts in the City and during what hours of the day?

WHAT MIXTURE OF LAND USE WILL RESULT IN DESIRED LEVELS OF ACTIVITY? Mixed use developments have the potential of creating round-the-clock activity as evidenced by Quincy Market but developments such as the Prudential Center indicate that a mixture of uses on a single site does not guarantee a lively development. Government Center replaced the complex mix of very active land uses in Scollay Square with a predominantly 9-5 office district and much of the new development in the Financial District during the past twenty years has eliminated active ground floor commercial uses, replacing them with barren, windswept plazas (left over space) and non-active uses such as banks and brokerage offices. As a result large areas of non-residential Central Boston are devoid of people and activity during the evening hours. SHOULD MIXED USE DEVELOPMENTS BE ENCOURAGED THROUGHOUT THE DOWNTOWN? SHOULD GRADE LEVEL USES WHICH PROVIDE INTEREST AND ACTIVITY FOR THE PEDESTRIAN BE INCORPORATED IN NEW DEVELOPMENTS?

SHOULD PARTICULAR LAND USES AND ACTIVITIES BE ALLOWED TO PREDOMINATE AND DISPLACE "WEAKER" USES? A variety of uses in Central Boston contributes to its diversity, interest and vitality. Expansion of uses such as institutions, office, and luxury residential development has often been at the expense of softer uses such as moderately priced housing, neighborhood retail facilities and manufacturing and warehouse uses. For example, much of the ground floor commercial space provided in new downtown office buildings is leased by financial institutions or franchise operations, producing a very limited combination of activities. In residential areas such as the Back Bay, Beacon Hill and the North End housing rehabilitation has meant a reduction in the range of housing options. AS COMPETITION FOR LIMITED LAND AND BUILDING SPACE CONTINUES HOW CAN LESS ECONOMIC BUT DESIRABLE USES BE MAINTAINED?

2. Activity and Amenity

One of Boston's unique characteristics is the high level of amenity provided for the public; can this characteristic be built into the development process so that desirable features like outdoor seating, trees, arcades and other architectural elements which provide weather protection are provided? What characteristics of privately developed open space result in windswept and lifeless plazas (e.g., First National Bank, Prudential Center, Federal Reserve Bank) instead of open space with vitality and interest (e.g., Faneuil Hall Markets, Boston Five, Filene's Park, Winthrop Square)? Strong facade, sign and design controls together with open space and pedestrian amenities have all contributed to the special character of the Faneuil Hall Markets. CAN STANDARDS INCORPORATING THESE AND OTHER TECHNIQUES BE DEVELOPED TO EVALUATE MAJOR NEW DEVELOPMENT SUCH AS COPLEY PLACE? Some major public amenities developed over the past decades have been unsuccessful, such as Copley Square and the Dartmouth Street Mall, while other efforts -- Waterfront Park for example -- have been great successes. HOW CAN LIMITED PUBLIC FUNDS BE CHANNELLED TO PROVIDE THE GREATEST PUBLIC BENEFIT IN TERMS OF PEDESTRIAN AND OPEN SPACE IMPROVEMENTS AND OTHER PUBLIC AMENITIES THAT ENHANCE AND GENERATE ACTIVITY?

D. CONSERVATION

Boston's reputation as an historic city with a rich tradition and heritage results from a unique combination of factors. These factors include architecturally significant buildings dating from the 17th century, many of which have been rehabilitated for new uses and 19th century neighborhoods or districts which have survived largely intact and function as vitally today as when originally constructed. Also important is the City's street system which retains much of its original character and parks and open space which evolved from the 17th century Boston Common to a major system of plazas and green areas. As new development continues in Central Boston, issues are raised concerning what buildings, districts, streets and open spaces should be preserved, how they should be preserved, and how new development should be integrated with the existing City fabric.

GIVEN BOSTON'S HERITAGE AND THE CONSTANT PRESSURE FOR REDEVELOPMENT, WHAT BUILDINGS, DISTRICTS, STREETS AND OPEN SPACES ARE IMPORTANT TO PRESERVE? WHAT IS INVIOLATE AND HOW DO YOU EVALUATE IT? Central Boston is noted for its historic districts such as the Back Bay and Beacon Hill as well as its numerous landmark buildings, some dating frm the 17th century. However, many other areas (South End, Charlestown, North End, Financial District, among others) and buildings (United Shoe Machinery, Youth's Companion, Transcript, New Studio) display significant architectural and/or historic merit but have not received the same degree of recognition or legal protection as our more prominent districts and buildings. Boston's significant buildings and streetscapes are a major factor in the decision of people to live, work, visit, and invest in the City. At the same time the need for intensified development and building space is present. HOW CAN DEVELOPMENT DECISIONS BE MADE TO ACCOMMODATE CONSERVATION

AND PROVIDE SITES FOR NEW DEVELOPMENT? Are there means to identify distinctive sections where conservation is most desirable? How can awareness of the beneficial effects of retaining architecturally or historically significant buildings and districts be achieved?

HOW CAN A REASONABLE BALANCE BETWEEN CONSERVATION AND NEW DEVELOPMENT BE ACHIEVED? Previous development has often resulted in the demolition of significant buildings as well as whole districts of the City (West End, Scollary Square). Many notable buildings have been insensitively altered or enlarged. New storefronts in particular have often failed to acknowledge the overall design of the building. Inappropriate new development has also had a negative impact on the historic character of Boston. How should these pressuers be addressed? Can sites be identified where high-rise and large-scale buildings will enhance Boston's traditional characteristics? Can new construction which incorporates compatible materials, relative scale, height, and mass achieve respect for the surroundings? Can incorporation of landmark structures and elements within new development sites be achieved without compromising essential landmark qualities? Are there appropriate conditions where contrast, in scale, mass, or materials would enrich the surrounding historic areas?

Historic open spaces, such as the Common and Garden, have had developments of varied scale at their edges. The conservation of large historic open spaces has been a long tradition. Encroachment has mainly been through underground changes such as the Under-Common garage, in appropriate roadways such as the Bowker overpass and Storrow Drive, or through the effect of wind and shadow from adjacent new development such as Tremont-on-the-Common. HOW CAN NEW CONSTRUCTION BE PREVENTED FROM CREATING NEGATIVE DESIGN AND ENVIRONMENTAL IMPACTS ON HISTORIC PARKLAND?

ENVIRONMENT AND ENERGY

Environmental Impacts
Energy
Infrastructure

ENVIRONMENT

INTRODUCTION

The cumulative effects of each new building constructed in Central Boston could detract from the City's environmental quality and overtax its energy facilities and infrastructure: the transportation, sewerage, and water systems. Currently, environmental quality and the capacity of the infrastructure systems are jeopardized.

Air quality in Boston does not meet some of the standards established under the Federal Clean Air Act of 1970, and development projected to continue during the next decade could make it difficult to reduce pollution levels. More traffic and increased construction activity, energy production, and industrial processes typically accompany urban growth and increase the levels of chemical pollutants and dust in the air. Tall buildings can trap chemical and particulate pollutants, if the buildings significantly disrupt natural air flow. If new development is not carefully controlled, its environmental impacts will hinder efforts to improve air quality. Failure to make reasonable progress in that direction can result in federal sanctions and the loss of Federal funds. Even worse, polluted air exacerbates the incidences of respiratory diseases, damages vehicles and buildings, and makes urban life generally unpleasant.

Water quality is also threatened, if the impacts of urban growth are not carefully controlled. The Boston Inner Harbor and the Charles River Basin are unique assets in the City. Over the years, they have served manufacturing, fishing, and other commercial sectors; boating enthusiasts; tourist and residential development. However, water quality in the Inner Harbor and Basin has deteriorated. Pollution has detracted from the aesthetic values of both bodies of water and has limited the growth of fishing, tourism and, residential development.

New development can create negative impacts on air and water quality, affecting the environment city-wide. Other development impacts are more localized, changing the microclimate -- the small-scale environment in the immediate vicinity of a new project. Noisy, windy streets -- bereft of sunlight -- result when the effects of development on the microclimate are ignored.

In the urban environment where open space is limited, and where tall buildings can create dark street canyons, access to sunlight is important. Losing it is a potentially serious impact of new development. As Central Boston grows, shadows from tall buildings detract from peoples' delight in the open space, whether as a place to lunch in warm months or to simply move across in windy winter months.

Excessive wind velocities can be equally unpleasant side effects of new construction. In Boston, where the average annual wind speeds are high, the presence of tall, closely spaced buildings often exacerbates localized conditions. At ground level around such developments as the John Hancock and Prudential Towers, the First National Bank, One Boston Place, and 100 High Street, higher than normal winds cause discomfort, impede walking, and create hazardous conditions even for hardy pedestrians.

Excessively noisy environments can interfere with speech and hearing, lead to physical and psychological stress, and generally lower the quality of life. In Boston, as in other major urban areas, cars, planes and construction can create intolerable ambient noise levels and reduce the desirability of some areas. In East Boston, for instance, aircraft noise has eroded property values and jeopardized Federal financing for housing.

The first section of this chapter, "Impacts of Development", describes Boston's air and water quality. It outlines the impacts of additional traffic, tall buildings, construction activity, energy production, and industrial processes on the City's environmental resources and microclimates, and it delineates current regulatory policies, controls, and strategies that regulate the environmental impacts of urban growth.

The second section of this chapter focuses on energy efficiency, a recent factor in development decisions. Providing an energy profile of Boston, the second section describes current patterns of energy consumption and supply and discusses how they may change. Many factors affecting future consumption and supply fall outside the City's jurisdiction, but local government can influence energy use through development controls. To help in formulating such controls, this chapter suggests opportunities for achieving energy-efficiency through landscaping, building design, and energy systems.

The third section of this chapter deals with the City's infrastructure -- transportation, water supply, and sewerage systems. The capacity of all these systems is limited: Boston's consumption of water is approaching its safe yield and by 1990 could exceed safe yield by twenty million gallons per day. The sewerage system was built one hundred years ago and, while portions of it have been improved, the system is inadequate to accommodate the flow during peak-hours. Sewer overflows are discharged into Boston Inner Harbor and the Charles River Basin and are the central cause of water pollution.

Congested streets, and overcrowded and unreliable mass transit make it difficult at times to move about the City on foot or by car. New development could impede movement even more. Generating additional traffic, projects not yet built could further congest narrow streets, contribute to air pollution and energy inefficiency, and increase noise levels downtown. The infrastructure section briefly describes the capacity of transportation, water, and sewerage systems; notes issues to consider in formulating development guidelines and describes current regulatory controls policies, and strategies governing infrastructure systems.

AIR QUALITY

Federal air pollution regulations establish national ambient standards for seven pollutants (see Table VIII-1). Air quality in Boston does not meet some of them. Carbon monoxide and hydrocarbon levels are high, due to auto, industrial, and commercial emissions. The Commonwealth, as well as most of the Northeast, remains in "nonattainment" for ozone; that is, the amount of ozone in the air exceeds Federally-acceptable levels.

Failure to meet the pollution control standards by 1982, or to make reasonable progress toward meeting them, would have resulted in Federal sanctions, had the Commonwealth not received an extension until 1987. Under the Act, states not in compliance can become ineligible for federal transportation, sewer, and water funds, and Federal officials can prohibit construction of new sources of pollution.

New England suffers from acid rain, a currently unregulated pollutant which occurs when sulfur oxides and nitrogen oxides, emitted mostly from tall stacks of minimally-controlled coal-fired plants in the Midwest, are transformed into acidic sulfates and nitrates high in the atmosphere and carried eastward. Acid rain has been shown to affect water quality and vegetation.

In Massachusetts, transportation sources generate most of the carbon monoxide and hydrocarbons polluting the air. Energy production incinerators, construction and demolition, and, to a lesser extent, transportation sources generate particulates. The combination of several pollutants -- hydrocarbon, and nitrogen oxides -- in the presence of sunlight creates ozone. Ozone travels with the prevailing winds, with much of the ozone originating out of state.

The adverse health effects of air pollutants are well known. Sickness from air pollution is costly, even though total costs can never be quantified. Increased costs for medical care and hospitalization; time lost by wage earners due to sickness; and food crops damaged by air pollution all add to the cost of doing business within the State. The costs are staggering. In a review of twenty-three studies done in a ten-year period, the American Lung Association estimated that the health cost of polluted air nationally exceeded ten billion dollars annually (in 1978 dollars). Air pollution has reduced worker productivity by thirty-six billion dollars annually, according to a study conducted by the U.S. Environmental Protection Agency (EPA) between 1977 and 1979.

Development proposed for Central Boston during the next decade might contribute to higher pollution levels, increase the difficulty of meeting national standards, and retard the current progress towards meeting air quality standards. Factors of development which could degrade air quality include; increased traffic, taller buildings, construction activity, energy production, and industrial processes.

Traffic Impacts

Carbon monoxide, hydrocarbons, nitrogen oxides, and lead are major polluting by-products of automobile combustion. Traffic generates seventy percent of

the hydrocarbon emissions and approximately ninety percent of the carbon monoxide emissions in Boston. Vehicular pollution is exacerbated by traffic congestion. When vehicles are running at low speeds or idling, their emissions are greater.

Carbon monoxide levels, because they are easily affected by the location and form of an area, are sensitive to new development. Narrow streets, flanked by tall buildings, create a canyon-like effect, trapping pollutants between buildings and impeding dispersion. This temporary accumulation of high concentrations of carbon monoxide, or "hot spots", occurs where traffic is most congested. Measurements taken at five major downtown intersections indicate the presence of such phenomenon; the eight-hour carbon monoxide Federal ambient standards are commonly exceeded at the sites. At present, no location measured in Boston exceeds the one-hour carbon monoxide standard of thirty-five parts per million (ppm), although a proposed Federal measure to change the standard to twenty-five ppm could result in new violations within Boston.

The following changes could minimize vehicular pollution:

- Reduce congestion by altering the locations of access and exit ramps on major arteries and taking other steps to reduce traffic (see Transportation section).
- Reduce "hot spot" effects near parking garages by eliminating queuing -- a problem created by the current fee collection process.
- Retain open space in the City to enhance the dispersal of pollutants.

Impacts of Tall Buildings

High-rise structures, particularly when built in the same vicinity, can adversely affect the City's air quality. The street canyons they create, trap pollutants. Concentrations of tall buildings wall of prevailing winds and block the normal flow of air, inhibiting dispersal of pollutants. In Boston sea breezes can prevent the agglomeration of pollutants downtown. However, construction of tall buildings, particularly along the waterfront, can significantly diminish this beneficial effect. Because high-rise structures generate more vehicular traffic, their construction can contribute to congestion and air pollution. Even when ambient air quality levels are within acceptable levels, "hot spots" created by traffic congestion, can detract from air quality at specific sites.

The City of Stuttgart recognizes the value of air flow in improving air quality and has formed a climatological commission to review development proposals in that light. To ensure the maintenance of air channels open to prevailing winds, the commission evaluates the location height and massing of proposed projects.

Construction Impacts

Construction activities are prime sources of particulate pollution downtown. Building demolition, land clearance and excavation, exposed aggregate storage piles, and the transport of debris and fill generate dust and increase the particulate levels.

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Emissions from construction and land preparation activities depend on such factors as soil characteristics, meteorological variables, and construction practices employed. Because these pollutants are not vented or discharged through a stack, source, or point, they are referred to as "fugitive emissions." The EPA calculates that fugitive dust pollution from land clearance and excavation activities can equal four pounds per cubic yard. When combined with Boston's background level of 1,933 tons per month, the pollution from construction can greatly exacerbate the existing particulate problem. Continually spraying a site with water or other appropriate chemicals, and covering debris and fill in transit and in storage, would minimize particulate levels generated by construction.

Asbestos in older buildings slated for demolition is hazardous to air quality and public health. Asbestos, once used for insulation and fire-proofing, may be a carcinogen. Asbestos particles can become airborne unless removed with caution prior to building demolition. Control of asbestos is regulated by the Boston Air Pollution Control Commission through its regulation on abrasive blasting and through a prohibition on asbestos in new construction by the U.S. Environmental Protection Agency.

Impacts of Energy Production

Commercial space heating has not polluted the air in Boston, but it might in the future. Most downtown businesses have relied on Boston Edison's steam for heating. Unfortunately, the Boston Edison system is obsolete, with high operating costs. Higher fuel costs have induced some commercial customers to converting to private fuel-burning systems. The loss of these customers has meant even higher costs for remaining customers. The shift to smaller fossil fuel systems could result in more pollution from dispersed sources and eventually jeopardize air quality.

Because of the rising cost of fossil fuels, existing facilities may be converted and new ones built to generate energy for less money. New sources may increase air pollution. The U.S. Department of Energy has begun a program to convert existing energy facilities to coal-burning plants, and seven are proposed for Massachusetts. Such conversions, coupled with higher sulfur fuel variances, might increase sulfur dioxide and particulates within the Commonwealth to unacceptable levels.

Proposed Federal regulations favoring cogeneration projects could result in the installation of large diesel or gas turbine-powered generators in Central Boston. Although cogeneration facilities reduce total fuel consumption and pollution by utilizing waste heat, they also change the nature, location, and type of pollution generated. The change in type of pollution from these facilities is difficult to quantify, as is the cumulative effect upon air quality standards.

Industrial Impacts

Light-duty industrial development in Central Boston is relatively minimal. Of the major industries within this area, most generate hydrocarbons. The State inventory of air pollution sources identified twelve major hydrocarbon sources within Boston, each contributing in excess of one hundred tons annually.

Industrial processes emitting hydrocarbons in Boston include coating operations, gasoline storage facilities, degreasers, dry cleaners, graphics and printing, and ship repair and maintenance. Table VIII-2 summarizes emissions from stationary source after implementation of the State Implementation Plan.

REGULATORY CONTROLS AND POLICIES

New and existing sources of air pollution are regulated under the Federal Clean Air Act, and State and local ordinances. Under these regulations, sources must meet emission limitations within a specified deadline. New development must conform with new source standards and offset new pollution levels through reductions in emissions of existing sources. Depending on the City's ability to curb existing pollution sources, additional controls on existing and new pollution sources throughout the Boston area may eventually be necessary to meet attainment deadlines. Described below are the applicable Federal, State, and local requirements.

Clean Air Act

Under the Federal Clean Air Act, EPA established national ambient air quality standards for seven pollutants. Primary standards, designed to protect human health, and secondary standards, designed to safeguard public welfare, have been established for these pollutants. The State's pollution control regulation incorporates the Federal ambient standards.

Under the Act, the State should have met the standards for each pollutant by December 1982. Because of the difficulty in meeting auto-related carbon monoxide and hydrocarbon standards, Massachusetts received an extension until 1987. The State Implementation Plan outlines the measures necessary to meet the standards and provides an annual margin for "reasonable further progress" towards attainment of the standards.

The Massachusetts State Implementation Plan was conditionally approved by EPA last fall. Final approval of the plan is dependent upon receipt of additional information on small sources and demonstration of "reasonable further progress" within the greater Boston area.

State Implementation Plan

Recognizing the varied sources of air pollution, Massachusetts' State Implementation Plan incorporates controls on both mobile and stationary sources. The transportation portion of the plan includes a vehicle inspection/maintenance program designed to insure maximum ongoing efficiency of automotive pollution control devices; improved mass transit program to encourage greater ridership and less dependence upon private automobiles; implementation of road improvements to reduce congestion; and a commercial off-street parking freeze for the Boston Central Business District and for Logan Airport (discussed in greater detail in the Transportation section). The inspection/maintenance program went into effect in April 1983, and it is expected to help Boston reach carbon monoxide and hydrocarbon standards by 1987.

To accommodate new stationary sources, the Implementation Plan incorporates stringent controls on existing sources, as well as an emission offset growth policy for new development. Under the plan, existing sources must utilize reasonably available control technology (RACT), that is, a minimal level of control taking into account economic and technology considerations. Reductions from existing sources must annually demonstrate reasonable progress towards meeting standards.

In response to EPA's policy of restricting major new or modified stationary sources in nonattainment areas, the State adopted an emission offset policy. Under such a policy, projects which would increase already excessive levels of pollutants, according to Federal standards, must control emissions to the greatest degree possible. New sources are required to utilize "lowest achievable emission rate technology" (LAER) established by the State as either the lowest level contained in the implementation plan of any state, unless the permit applicant can demonstrate that such a level cannot be achieved; or the lowest emission level which is achieved in practice within a relevant industrial category.

Major new sources of one hundred tons or more must more than offset their emissions through reductions obtained from existing sources, as well as demonstrate that they will not adversely affect progress towards achievement of standards within the air quality region. Major Boston hydrocarbon sources affected by the regulation include printing and publishing; dry cleaning; ship repair; and coating operations. Table VIII-3 shows potential major sources by industry.

If standards are still exceeded, the State will need to develop further restrictions on major new sources, and new controls on smaller, unregulated sources.

Local Regulatory Activities

The Boston Air Pollution Control Commission (BAPCC) is the local agency responsible for enforcement and adoption of the municipal air pollution control ordinance. The Commission, comprised of five members appointed by the Mayor, regulates pollutant emissions within municipal boundaries. Regulations adopted by the Commission must, at a minimum, be as stringent as state regulations, and must be approved for consistency with State regulations. Under City of Boston Code Title 7, Section 50, the Commission is empowered to regulate fuel burning activities, open burning, abrasive blasting, and the commercial parking freeze. The sulfur content of coal and residual oil, as well as opacity particulate levels, are regulated by the ordinance.

The BAPCC exercises some control over development in Central Boston several ways. One, BAPCC developed stringent regulations to control particulate pollution that renovation projects can generate. The regulations require blasting activities to be completely enclosed, and all loose materials attributable to the blasting to be removed; and they prohibit the use of materials containing free silica or re-used abrasives. Second, development is most affected by the off-street commercial parking freeze managed by the Commission (described in greater detail in the Transportation section). The freeze, initially adopted as part of the State's transportation control plan within the State Implementation Plan, prohibits increases in the number of

commercial parking spaces above 1973 levels. Parking facilities affected include those within the Central Business District and at Logan Airport. Spaces which are eliminated automatically revert to the City parking bank for reallocation by the Commission.

A third mechanism, the "Controlled Trading Program", was established under the Clean Air Act in order to provide incentives for improving air quality without restricting economic growth. This program serves several functions: it allows plant officials to determine the most cost-effective means of meeting air pollution standards; it builds in a pollution margin for new growth; and it minimizes regulatory review.

The Controlled Trading Program is applicable to both new and existing development. Developers seeking to locate in nonattainment areas can use the program to build in a growth margin for additional development. By reducing pollutants beyond what is currently required, developers can credit the surplus reductions for future growth. For instance, if a permitted source must reduce pollutants by fifty tons and chooses to reduce by seventy tons, the additional twenty tons may be credited for future expansion. Such a policy allows new expansions, even though an area may be in nonattainment. In addition, reductions gained through improved maintenance or more efficient facility operations can be credited to new growth.

The Controlled Trading Program also offers existing firms an innovative way of meeting air pollution regulations. Under the program, firms determine the most cost-efficient means of meeting standards within their own facilities. Rather than requiring that each point source meet a particular emission limitation, firms can determine the mix of controlled sources, provided the aggregate emission level does not exceed the permitted level of the entire facility. This is similar to putting a "bubble" over a firm. Under the Controlled Trading Program, if a firm has five point sources permitted to emit ten tons of pollution each, the firm can now regulate whichever point sources it chooses, provided total emissions do not exceed fifty tons. It can thus choose to regulate all five stacks, control three, or any other combination within the fifty tons total emissions limit.

To assist new developments, the BRA is developing an emission reduction credit bank. Banked reductions will include those generated from reductions at City facilities; those conveyed to the City; and those received from facility shutdowns. Applicants can petition for use of these banked reduction credits to offset emissions from new development. Priority will be given to those projects which reinforce the City's development policies.

In addition to the regulatory controls in place at the Federal, State, and local level, other development policies could help to reduce air pollution. Well-sited parks and open space, as noted previously, can improve air flow and disperse pollutants. Vegetation within the parks is capable of absorbing dust and pollutants. Trees cut down on dust in the air through the filtering effect of their foliage and needles; some scientists believe trees can reduce gaseous compounds from the air, thus detoxifying dirty air generated by industrial processes. Development guidelines promoting new ways, such as the above, to improve air quality can minimize the adverse impacts of urban growth and help Boston to achieve State and Federal air quality standards.

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WATER QUALITY

Both Boston Inner Harbor and the Charles River Basin add a dimension to Boston that only a few other cities in the country can claim. Historically, the Inner Harbor has helped to strengthen the local economy, serving the needs of fishing, manufacturing, and other commercial sectors. Both bodies of water enhance the aesthetic appeal of the City and provide recreational opportunities for residents and visitors. But poor water quality threatens to turn these assets into liabilities, which raises development policy issues.

Water quality encompasses not only the chemical properties of the water column, but also the aesthetic properties of the water body, floatable debris, oils, temperature, and odors. In addition to making the water unpleasant to be near, poor water quality can interfere with marina and boating activities, shellfish harvesting, fishing, certain industrial uses, and residential use. Water pollution upsets the balance of animal and plant life; reduces the variety of species that can survive in the water; and leads to a concentration of heavy metals and other toxicants in fish and shellfish that otherwise would be harvestable.

Poor water quality also can undermine the economic viability of development projects. For example, Massachusetts Housing Finance Agency denied funding for a housing development proposed for the Fort Point Channel, in part because of the unattractive and unhealthful quality of the water. Fort Point Channel, a key revitalization area, is one of the most polluted segments of the Inner Harbor. Improved water quality and creation of public access to the water with pedestrian amenities would enhance development and help sustain mixed use activities.

The shellfishing industry in Boston Harbor could grow, but poor water quality prevents it. Open shellfishing is prohibited in Boston Harbor due primarily to high bacterial counts. Restricted shellfishing, that is, shellfishing requiring purification, is permitted in certain areas and brings in approximately twelve to fifteen million dollars per year (wholesale prices). With improved water quality, the shellfishing industry in Boston Harbor could grow to thirty million dollars annually.

Boston Inner Harbor and the Charles River Basin currently do not meet the Massachusetts' water quality standards, which set acceptable levels for various water uses. Table VIII-4 contains the standards and criteria for the Basin and Inner Harbor.

The Inner Harbor is classified as an "SC" body of water -- a saltwater body which should be suitable for aesthetic enjoyment, recreational boating, and as a habitat for wildlife, food and game fishes.

Pollution in the Inner Harbor occurs primarily from:

- o combined sewer overflows (CSO) causing high coliform bacterial counts, high nutrient levels, and relatively low dissolved oxygen levels;

- o stormwater runoff which carries suspended solids, fecal bacteria, nutrients, heavy metals, and road oils;

- o sludge resulting from sewerage processing at Deer and Nut Islands;
- o loose, floatable debris from dumping and from breaking up of dilapidated shorefront structures;
- o filling, dredging, and construction which cause suspended solids in the water column;
- o oil and waste from boating activities;
- o industrial effluents.

Comparing existing water quality sampling data with the state SC standards indicates that several of the parameters violate their respective criteria. (See Tables VIII-5 to VIII-8 for general water pollution data and specific site samples in Boston Inner Harbor). Dissolved oxygen (DO) levels, one of the most important indicators of water quality, are considerably lower than the prescribed 6.0/mg/l. A low level of dissolved oxygen, resulting from the fifty-one CSOs in the Inner Harbor, makes the water unsuitable for, many forms of fish. Though CSO outfalls are the most significant source of pollution in this water body; surface oils, floating debris, and odors also detract from the Harbor and shorefront. Heavy metals, another source of pollution, are found in high concentrations as indicated in Table VIII-9.

The Army Corps of Engineers has proposed removing floatable debris and dilapidated structures from Boston Harbor, but cost apportionment negotiations have delayed implementation. The Corps estimates the clean-up would cost 19.4 million dollars and that the non-Federal share would be 16.8 million dollars. The Corps has indicated that the majority of the clean-up costs could be collected from the individual property owners, and the State concurs. However, it would be difficult to recover these costs, and neither the City of Boston nor the Commonwealth currently could afford to incur the significant up-front costs. Because of the cost apportionment problems and because water quality improvement is not a priority for the current Federal administration, clean-up is not imminent.

Sludge from the Deer and Nut Islands sewerage treatment facilities also pollutes the Harbor. The current status of progress toward eliminating this pollution is addressed in conjunction with the discussion of the sewer system serving the Downtown area.

Another major factor affecting the viability of Boston Harbor is the progressive filling of the Harbor. Historically, the original land area of Boston was approximately 780 acres. However, bays, coves, and inlets were gradually filled and the land area extended into open areas of the Harbor to create more room for development. Land fill increased the City's land mass to more than three times its original size. The most extensive areas of the Harbor that were filled include South Boston between 1836 and 1891, the East Boston pier area in the 1880s, and the Logan Airport area between 1922 and 1928. Filling operations continue today. In the late 1960s, another major part of the Harbor was consumed by the Bird Island Flats filling project which added 234 acres to Logan Airport. In 1980 the Seaport Development at the Boston

Marine Industrial Park claimed more of the Harbor adjacent to South Boston. Smaller sites have also claimed portions of the Harbor in recent years, and currently several private development proposals would require still more filling operations.

Boston Harbor's value as a unique natural resource and its aesthetic and economic importance could be destroyed. Continued filling would further alter the Harbor's configuration, create crowded conditions for vessels, eliminate recreational boating opportunities, and perhaps change the microclimate along the waterfront. Although many proposals to fill portions of the Harbor are small, the cumulative effects could be significant. When proposals are for non-maritime uses -- such as those for parking, office, hotel, residential, or roadway construction -- there is little justification for altering Boston Harbor.

The Charles River Basin is classified as a "C" inland body of water which should be suitable for recreational boating, water contact recreation, for certain agricultural and industrial uses, and habitat for wildlife and fish, and have good aesthetic value.

However, CSOs and salt water intrusion detract from the Basin's suitability. The latter inhibits vertical mixing, causing a stagnant, dense bottom layer of water devoid of life and low in dissolved oxygen. A pungent sulfur odor emanates from the Basin as a consequence. Several of the water quality parameters in the basin are in violation of the State criteria as indicated in Table VIII-10. Tables VIII-11 and VIII-12 also indicate high concentrations of heavy metals and sediments. Improvement of water quality in the Basin through elimination of CSOs and the stagnant bottom layer of water would enhance this segment of the River. (The saltwater intrusion and CSO problems experienced in the Basin also will be addressed in the section on sewerage treatment facilities.)

REGULATORY CONTROLS, POLICIES, AND STRATEGIES

The primary legislation governing water quality is the Federal Water Pollution Control Act of 1972 Amendments (P.L. 92-500), which amended the Water Pollution Control Act of 1965. In response to the earlier Federal legislation, Massachusetts established the Massachusetts Clean Waters Act (Chapter 21 of the Massachusetts General Laws) and Massachusetts Water Quality Standards, which are administered by the Division of Water Pollution Control and are in conformance with the requirements of the 1972 Amendments.

Pursuant to Section 208 of P.L. 92-500 the Metropolitan Area Planning Council has established a Water Quality Management Plan for Metropolitan Boston. The final plan provides for establishment of an interagency committee to coordinate and expedite action on the various wastewater management projects planned for Boston Harbor. Participants in the committee include the Massachusetts Executive Office of Environmental Affairs, represented by its Office of Coastal Zone Management and Environmental Impact Review Office (MEPA); the Massachusetts Department of Environmental Management (DEM) and Environmental Quality Engineering (DEQE); the Metropolitan District Commission (MDC); the Metropolitan Area Planning Council (MAPC); the U.S. Environmental Protection Agency (EPA); the Boston Water and Sewer

Commission (BWSC); and the Boston Harbor Citizen's Advisory Committee (BHCAC). Among the eight agencies, the City and the BRA have the most direct input into water quality planning for the Harbor through the BWSC, and through MAPC memberships.

The MDC has taken steps to reduce pollution in Boston Harbor and the Charles River Basin. With the assistance of Federal, State, and City environmental agencies, the MDC is developing several projects to improve the metropolitan sewerage system. To control the impact of combined sewerage entering the Charles River, the MDC has constructed a CSO control and treatment facility in the Basin, adjacent to the Charles River Dam which was built to prevent salt water intrusion. The facility and the dam should help to gradually recover and maintain the quality of water in the Basin.

Section 402 of P.L. 92-500 established the National Pollutant Discharge Elimination System (NPDES) which limits the amount and nature of effluent to be discharged into the nation's waters. All municipal treatment plants and all industries discharging directly into waterbodies are required to obtain a NPDES permit, specifying the type and quantity of effluent the facility may discharge. This permit system is administered by the Commonwealth for EPA. While point source control does involve greater expenditure for an industry, the NPDES' requirements are nationwide and therefore do not place Boston at any disadvantage in terms of industrial development.

Title II of P.L. 92-500 provides for Federal funding of seventy-five percent of the costs of the planning, design, and construction of publicly-owned wastewater treatment facilities. This provision specifies a number of conditions, including a requirement that the agency operating the facility develop a system of user charges based on the proportional wastewater volume of each user. Title II also provided for a system of industrial cost recovery to recover from specific industries that portion of the capital costs of the work necessary to treat their share of the total wastewater flow. This clause has since been rescinded, and EPA is in the process of developing a new industrial cost recovery regulation. The MDC is developing a pretreatment program (point source control) and a system of user charges.

The National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) (administered by the Massachusetts Executive Office of Environmental Affairs (EOEA)) exert indirect control over water quality. Under NEPA, Federal agencies must consider the environmental consequences of a proposed federal action. For major projects the principal mechanism for this analysis is the Environmental Impact Statement process. Both the issuance of NPDES' permits for new sources and grants for construction of treatment facilities are subject to review under NEPA. Under MEPA, projects undertaken or financially assisted by the State, or for which permits are issued by a State agency, must minimize adverse impacts on the environment. The principal means of evaluating the potential for impact is the Environmental Impact Report process.

In accordance with the Wetlands Protection Act, (M.G.L. c.,131, s. 40), Massachusetts established regulations stipulating that no person shall remove, fill, dredge or alter any bank, fresh water wetland, coastal wetland, any land under the water, or any land subject to tidal action or coastal storm flooding without receiving and complying with an Order of Conditions issued under

these regulations. In Boston these regulations are administered by the Boston Conservation Commission. The Commission may deny a permit for construction, or stipulate through an Order of Conditions, controls which must be implemented. If a permit is denied, the proponent may appeal to DEQE. Provisions of the Wetlands regulations apply to any activity within one hundred feet of any coastal or inland wetland feature or within one hundred feet from the elevation of the one hundred year flood. Figure VIII-1 indicates the elevation of the 100 year flood for the downtown area of Boston.

Construction in marine coastal areas is also regulated by DEQE through issuance of Waterways Licenses. The licensing regulations were established in order to protect the public rights of fishing, following, and navigation and all rights in the Commonwealth tidelands under DEQE jurisdiction. The Army Corps of Engineers also must issue a permit for construction, dredging, or alteration in navigable waters, based on protection of the public's interest and rights in these waters.

In formulating new policies and strategies to improve water quality, several management practices and treatment methods exist. Table VIII-13 provides a listing of them.

WIND, SHADOW, AND NOISE: DEVELOPMENT IMPACTS ON THE MICROCLIMATE

NOISE

Excessive noise interferes with speech and hearing, contributes to physical and psychological stress, and can lead to hearing impediment. In urban environments, industrial and commercial activity; cars, trucks, and airplanes; and construction all generate the background, or ambient noise levels. Some of these, especially pile drivers, airplanes, and heavy-duty trucks, create severe intermittent noise.

Ambient noise levels have increased downtown with more traffic and construction projects. People living and working in the vicinity of a construction project are subject to the noise they generate for periods as long as four years. Intermittent noise from such activity can be extreme: a single diesel truck, heard from fifty feet away, emits noise approaching 90 dB (A), and a pile-driver heard from the same distance, can be as loud as 100 dB decibels (A). Residents of East Boston, the Waterfront and South Boston are exposed to daily intermittent noise levels as high as 105 dB (A) from flights out of Logan Airport. Massport's proposed development of Bird Island Flats, which would increase the number of cargo flights and ground transportation, is likely to raise the level of noise. Jet aircraft flying at one thousand feet create an average level of 105 dB (A).

It is possible to control noise and to set standards for acceptable levels of noise. Though tolerance for noise varies amongst individuals, the U.S. Environmental Protection Agency has defined certain levels as requisite for protecting public health. 70 dB (A), averaged over twenty-four hours, should not be exceeded in order to guard against hearing loss. (55 dB (A) is the level at which speech and hearing impairment usually begins.) Exposure to noise levels in excess of 90 dB (A) for even eight hours a day will cause significant hearing damage; levels greater than 110 dB (A) can lead to permanent damage or loss. Consequently, increased frequency and duration of activities generating loud noises are potentially harmful to urban dwellers.

In 1975 noise levels downtown ranged from 54 dB (A) at the center of Boston Common, to 74 dB (A) at Eliot and Washington Streets and about the same for Boylston and Arlington Streets, according to a study by the Boston Air Pollution Control Commission. As long as eight years ago, noise levels in the City exceeded Federal standards.

Remedies are possible, as changes at Downtown Crossing and a North End health facility illustrate. The City designated the Crossing as an auto-restricted zone, and a noise sampling program was conducted to measure the change before and after the restriction was imposed. On Winter Street the maximum one-hour level decreased from 83 to 76 dB (A), and the average weekday level dropped by three decibles. (See Table VIII-14).

Construction of an elderly health facility in the North End was jeopardized by high noise levels. In 1980 the U.S. Department of Housing and Urban Development (HUD) rated the proposed site as unacceptable for residential use. Noise attenuation measures facilitated financing and construction of the project but if noise attenuation measures were not implemented, HUD would

not have provide financial support. The building needed immobile double-glazed windows to keep out the street noise and consequently, it also required air conditioners and ventilation. Though noise levels can be mitigated, it is not without other costs in most instances.

REGULATORY CONTROLS AND POLICIES

Reduction of noise impacts in the City is dependent upon control of vehicular volumes and flow patterns, enforcement of the use of noise attenuation devices on construction equipment and vehicles, and upon employment of a sufficiently large staff to enable the Boston Air Pollution Control Commission to monitor noise levels, respond to complaints, and generally enforce the City's noise regulations.

The Boston Air Pollution Control Commission's enforcement authority and the City's noise regulations are the most effective mechanisms that the City has for controlling noise emissions. The Boston Air Pollution Control Commission has adopted Regulations for the Control of Noise in the City of Boston (1972, amended 1976) which restrict noise according to residential, residential/industrial, business, and industrial zoning districts. In a residential zone the maximum noise level may not exceed sixty decibels (A) (daytime) and fifty decibels (A) (nighttime) and in an industrial zone, the least restricted, the maximum may not exceed seventy decibels (A) at any time. Exceptions are indicated for construction, but these levels also are restricted to maxima according to zoning districts. These regulations are included in Appendix D.

Federal agencies have also adopted noise standards. The primary legislation controlling noise is the Federal Noise Control Act of 1972. The Act provides for a division of powers between the Federal, state, and local governments, in which the primary Federal responsibility is for noise source emission control, with the State and other political subdivisions retaining the rights and authorities to control the use of noise sources and the levels of noise to be permitted in the environment.

EPA has established "Public Health and Welfare Criteria for Noise" as indicated in Table VIII-15. These criteria provide assistance to state and local governments in implementing the requirements of the Federal Noise Control Act. Although the tolerance for noise varies from one individual to another, the U.S. Environmental Protection Agency (EPA) has defined certain levels of noise which are requisite to protect public health. Noise levels are generally measured in decibels on an A weighted scale (dB(A)) which compensates for variations in human perception of noise. The levels are specified for a given period of time. EPA has identified 70dB(A) as that level averaged over a twenty-four hour period ($L_{eq\ (24)}$) which should not be exceeded in order to prevent hearing loss. $L_{eq\ (24)} = 55$dB(A) is the level at which speech and hearing interference usually begins. Exposure to noise levels of 90dB(A) for an eight-hour period daily will cause significant hearing damage, and any exposure to noise greater than 110dB(A) can cause permanent hearing damage or loss.

HUD has established Environmental Criteria and Standards (24 CFR Part 51) for acceptability of HUD-supported projects and has established necessary mitigation measures for new or substantially rehabilitated construction. HUD

criteria are given in units of L_{dn} which is the $L_{eq\,(24)}$ level with a 10dB penalty added to compensate for the more disturbing effects of noise occurring during the nighttime hours. These criteria are summarized below:

L_{dn} Level	HUD Acceptability
not exceeding 65dB(A)	Acceptable
between 65dB(A) and 75dB(A)	Normally Unacceptable
above 75dB(A)	Unacceptable

The U.S. Department of Transportation Federal Highway Administration (FHWA) has promulgated Noise Standards and Procedures (Policy and Procedures Memorandum, 90-2, February, 1973) for use by state highway agencies and the FHWA in the planning and design of highways and determining noise abatement measures for traffic-related noise.

The principal mechanisms for implementing EPA, HUD, and FHWA noise standards and mitigation measures are the Environmental Impact Report and Statement processes administered, respectively, by the Massachusetts Executive Office of Environmental Affairs (EOEA) and the U.S. Environmental Protection Agency (EPA).

WIND

Boston is a windy city with an average annual wind speed of 13.3 miles per hour. Winds from the southwest through northwest hit the City approximately half of the year; winds from the southeast are less frequent, occurring only two point five percent of the year. Average monthly wind speeds range from 10.9 miles per hour in July and August, to 14.4 miles per hour in January and February. Gale winds of thirty-two miles per hour or higher are expected at least one day each month, and gales are both more frequent and severe in the winter months.

The presence of tall buildings increases the already high wind velocity, affecting the microclimate along adjacent streets and sidewalks. Tall buildings protrude into the earth's boundary layer where wind speeds increase proportionately with altitude. The higher wind velocities exert more pressure, which in turn deflect the high winds near the top of a building downward. Consequently, wind velocities at the base of a tall building may be similar to those usually found at higher elevations, velocities often twice as great as the free flow, ground level winds. These winds are accelerated further as they flow around building corners. The dynamics are complicated even more when tall buildings are close together. Eddies and turbulence occur between buildings and speeds are increased by the tunneling effect.

It is possible to minimize the ill effects of tall buildings on ground level wind conditions. Solutions to wind problems in some cities have included building design modifications, vegetative or rigid wind barriers. Other methods --

prohibiting pedestrians from high wind areas or installing safety warnings -- do not remove the problem and are unacceptable solutions for Boston. Appropriate design modifications may include remassing of major building elements, lowering of building heights, and changing building width, spacing, gross shape and orientation. Add-on architectural solutions may include enclosed arcade and open canopies or wind screens such as rigid walls, fencing or tree plantings.

To determine pedestrian wind conditions expected from a proposed construction project, wind tunnel testing is conducted. The tunnel simulates the interaction between the built environment and statistically predicted wind directions and velocities throughout the year. The simulation can also test the efficiency of proposed design modifications and architectural solutions. Wind tunnel studies and appropriate mitigative measures are required for projects in several major cities in Europe and North America. San Francisco requires wind tunnel studies when public areas might be adversely affected. Toronto and Ottawa, two windy cities, also require analyses by wind engineers prior to the construction of tall buildings. The French central government discourages construction of tall buildings, in part because of their adverse impact on wind velocity and air quality. The government will not fund construction of buildings over seven stories proposed in cities with a population greater than 30,000, or for buildings over four stories in cities with a population of less than 30,000 persons. The government also discourages the construction of buildings over seven stories by developers utilizing private funds.

Prior to testing and to proposing modifications, standards are needed to describe what velocities are acceptable for pedestrian comfort and safety. Researchers in the United States, Canada, and Great Britain generally agree that an effective gust speed of thirty-one miles per hour, greater than one percent of the time, is the threshold above which people begin to find the wind environment unacceptable and dangerous.

Notes 3 and 4, following this chapter, describe how wind conditions are defined and how researchers arrived at their recommended standard; the information provided in the Notes should serve as a basis for policy formulation.

REGULATORY CONTROLS AND POLICIES

Currently, Federal and State environmental agencies have established no numeric regulatory standards for maximum permissible wind velocities. Wind impact analyses can be required, however, through the Environmental Impact Statement and Report process.

The National Environmental Policy Act (NEPA) requires that Federal agencies consider the environmental consequences of any Federal act. Wind impacts are not specifically included under NEPA; however, wind would be implicity included under the general heading of environmental consequences. Therefore, a wind impact analysis could be required in a federal Environmental Impact Statement (EIS).

The Massachusetts Environmental Policy Act (MEPA) specifically includes consideration of wind impacts in its implementation regulations. The principal mechanism for analyzing environmental impacts under MEPA is the Environmental Impact Report (EIR) and therefore, MEPA could require a wind impact analysis in an EIR.

SUNLIGHT AND SHADOW

Shadows cast by tall buildings vary with building height, time of day, and seasonal angles of the sun. Although modeling can illustrate the shadow effects accurately, models tell nothing about the impacts of those shadows. Impacts can seem most significant on warm days when workers, shoppers, and visitors want to enjoy downtown open spaces, as well as on winter days then the warmth of the sun is especially welcome.

Shadows, in addition to reducing the attraction of the City's streets and parks, can thwart efforts to promote solar energy. With increasing concern over fossil fuel shortages, urban residents have become more interested in solar alternatives. In Boston there are passive solar greenhouses atop residential buildings, and the sun warms glass-enclosed public spaces in winter. In the Fenway solar collectors heat an apartment building on a densely-settled street. Generally, solar technology has improved and become less costly but at time when new development may diminish access to sunlight.

REGULATORY CONTROLS AND POLICIES AND STRATEGIES

It is the City of Boston's practice to preserve access to sunlight in sensitive areas and to work with developers to mitigate the impact of building shadows. Other cities, such as Seattle and New York, have similar goals, supported by ordinances governing shadow impacts. However neither the City, the State or the Federal governments have established specific regulations for shadow impacts or access to sunlight. Although the City's planners and urban designers discourage the obstruction of sunlight in open space areas, there is no official policy regarding what sites to preserve, nor guidelines for developers to follow. The review of shadow impacts from proposed development occurs in cases where the City and design review authority: projects seeking 121A status, or zoning variances, or proposals in Planned Development Areas. Shadow impact analysis can be required through the Environmental Impact Statement and Report processes, but only for those projects that trigger the State or Federal review program.

The National Environmental Policy Act (NEPA) requires that Federal agencies consider the environmental consequences of any Federal act. Shadow impacts are not specifically included under NEPA. However, shadow effects could be implicitly included under the general heading of environmental consequences. Therefore, a shadow impact analysis could be required for a Federal Environmental Impact Statement (EIS).

The Massachusetts Environmental Policy Act (MEPA) specifically includes consideration of shadow impacts in its implementing regulations. The principal mechanism for anlayzing environmental impacts under MEPA is the Environmental Impact Report (EIR) and therefore MEPA could require a shadow impact analysis in an EIR.

NOTES:

1. Noise levels are generally measured in decibles on an A weighted scale (db(A)) which compensates for variations in humans' perception of noise. The levels are specified for a given period of time.

2. Wind conditions can be defined in several ways. However, when assessing the effects of pedestrian level winds, it is desirable to characterize the wind velocities by a single numeric criterion that can be compated to pedestrian conformity and safety criteria. The wind can be measured as a mean speed, U, or an average of wind speeds recorded over a certain period of time, usually one hour. It can also be characterized by its effective gust speed, U_{eff}. The effective gust speed is technically defined as $U_{eff} = U + k\sigma_m$ where σ_m = root-mean-square value of the wind speed fluctuations and k is a constant. Wind dynamic researchers N. Isyumov and A.G. Davenport have suggested the value of 1.5 for k since this value makes U_{eff} in the urban environment roughly equivalent to the mean hourly speed in more open areas to which the Beaufort wind scale refers.

   A third measurement of wind speed is the peak gust speed, U, which will occur a few seconds out of every five minutes during which a particular wind condition exists. In general, the peak gust speed will be about two times the mean speed, and the effective gust speed will be about 1.5 times the mean wind velocity.

3. The Beaufort Wind Scale, developed in 1805, provides a descriptive and numeric representation of the effect of wind on the environment. The original Beaufort Scale was developed to reflect average winds speeds at a reference height of 10 meters (approximately 30 feet) in an open, rural setting. This scale presented in Table VIII-16 has been adjusted downward by about 20 percent of reflect wind sppeds at the pedestrian level of 2 meters (6 feet). In an urban setting the mean wind speed is generally lower, although the gustiness is greater due to the interaction of the wind with buildings. Beacuse of this urban effect, the adjusted wind speeds in Table VIII-16 are considered to approximate the effective gust speed, U_{eff}. As noted in this Table, an U_{eff} of 25 to 31 miles per hour is the range between which pedestrians are inconvenienced when walking. Above 31 miles per hour progress in walking is impeded, and dangerous conditions can develop. Wind gusts of high velocity can be particularly more dangerous than constant velocities because they can catch a person unprepared. There is general agreement among researchers involved in wind dynamics that wind conditions creating effective gust sppeds of thirty-one miles per hour greater than one percent of the time are potentially dangerous and that this U_{eff} should be threshold above which the wind conditions are unacceptable and mitigative measures are required.

   Although pedestrian perception and tolerance of wind are subjective and generally related to a person's size and age, several researchers have developed wind guidelines for the comfort and safety of pedestrians involved in various activities in the urban environment. These guidelines are based primarily on the Beaufort Scale Cohen et al (1) examined the effects of wind on pedestrian behavior using the City of Boston as a

case study and have suggested one-hour average wind speeds and frequency of occurrence as guidelines for urban designers. These criteria are presented in Table VIII-17. The mean wind speeds also have been modified here to indicate the corresponding effective gust speeds. Interpolloting to determine an acceptable gust spped at a one percent frequency, a value for U_{eff} of 30.5 miles per hour was the speed above which the wind would not be acceptable. Reearchers Melbourne and Davenport also have established comfort and safety criteria which support that of Cohen and those indicated on the Beaufort Scale. Melbourne indicates that U_{eff} of thirty-one miles per hour, greater than one percent of the time in walking areas used only occasionally, is considered dangerous to the pedestrian. These standards were established for safety and comfort. However, they may also have economic implications for planners or developers since pedestrians may avoid locations where winds are generally excessive for certain activities.

ENERGY

Concern for energy efficiency is a pressing economic problem for Boston today. The City depends heavily on imported fossil fuels to met the operational, climate-control, production, and transportation needs of all sectors of the local economy. And Boston depends on growth in those sectors to generate jobs, to increase the tax base, and to maintain the City's vitality.

Only a few years ago, city planning reports made no mention of energy, unless the siting of storage facilities and transmission corridors was an issue. Energy was readily available and relatively inexpensive, hence it was not a factor in development decisions. Foreign oil has quintupled in price since 1973, rising with each supply interruption. With the cold climate and fragile supply systems, Boston, along with the rest of the Northeast, was especially affected. Fuel expenditures have risen in Boston, resulting in a drain on the local economy. In 1978 close to seven hundred million dollars was spent on energy consumption in the City.[1] Today, expenditures exceed 1.4 billion dollars, and approximately eighty-five percent of that amount left the local economy in 1981 alone to pay for oil and oil distillates, gas, coal, and uranium. Now energy impacts should be of major importance in formulating development policy.

Unreliable supplies of energy can affect future development because they influence the location decisions of firms. A study of corporations showed that energy factors, especially availability, were of major importance in determining their expansion plans in the United States through 1986.[2]

In Boston, residential uses account for one-quarter of the City's annual energy consumption; commercial sectors account for over fifty-five percent. Guidelines promoting energy-efficient siting and building design could help to lower the costs of living for local residents and the costs of operating for local businesses.[3] Benefits of such guidelines will extend far into the future. Just as municipal codes of the past have shaped today's urban form and structures, so too will policies formulated today established the physical and economic legacy for residents in the next century.

BOSTON'S ENERGY PROFILE

Consumption[4]

The commercial and institution sectors use more than half of the energy consumed in Boston. The major consumers are hospitals; offices in the finance, insurance and real estate sectors; and schools and colleges. The residential sector represents about one quarter of the City's total consumption. In all sectors, oil is the predominant fuel consumed (55.6 percent). In the non-residential sector, however, electricity represents a larger proportion (42.7 percent) of the total energy costs than any other single energy source.

In each sector, except for industry and transportation, the largest amounts of energy are needed for space heating purposes. In residential buildings, water heating is the second most important end use. In the commercial and municipal sectors, lighting is second most important. The industrial sector uses most of its energy to generate process steam. Chemical, food and paper

industries are the major industrial energy consumers. If Boston's demand distribution remains unchanged,[5] commercial space conditioning and lighting will account for most of the energy used in Central Boston, and residential space conditioning will follow in importance.

Supply Systems

Boston's electric utility, Boston Edison Company (BECo), serves forty cities and towns in the Greater Boston area. BECo has peak generating capacity of 2,723 Megawatts (MW), consisting of a mix of thirty percent nuclear, sixty-three percent oil, and seven percent gas turbines and diesel. In 1980 total system peak load was 2,100 MW, and the total system energy requirements were 10.7 million megawatt-hours (MWH).

BECO is a member of the New England Power Pool (NEPOOL), the regional power sharing and planning association. For the short term, heavy reliance on electricity has serious economic implications because BECo and NEPOOL are still approximately sixty percent dependent on imported oil. Planned conversion of much the electric generating capacity from oil to coal, nuclear, hydro, and wood could reduce both BECo's and NEPOOL's oil dependence to approximatel ten percent by 1987.[10] Because of its high cost, it is of critical economic importance that Boston consume electricity as efficiently as possible in order to minimize the City's energy dollar outflow and reduce its vulnerability to supply interruptions.

BECo owns Boston's steam district heating system (See Figure VIII-1.) The system is old, relatively inefficient, and no longer competitive with other energy sources.[8] By contrast, Northern European communities, where efficient district heating systems have been in use for the last twenty years, consume forty to sixty percent less fuel for heating, cooling, and electricity than American cities. A forty percent reduction in Boston's space heating and hot water bill would lead to an annual savings of approximately three to four hundred million dollars annually (1981 dollars).

Boston Gas Company (Boston Gas) sells and distributes gas to residential, commercial, and industrial customers in the City and in seventy-three other cities and towns in eastern Massachusetts. On peak days in 1981, Boston Gas distributed 572 million cubic feet (MMCF) from a variety of sources: natural gas from major pipelines (forty-seven percent), liquified natural gas (LNG) (fifty percent),[9] synthetic natural gas (two percent), and propane (one percent). In the winter of 1980-1981 the 66,521 MMCF sendout was supplied by pipeline gas (seventy-seven percent), LNG (17 percent) and synthetic natural gas (six percent).[10]

In the short-term, Boston is unlikely to increase its reliance (17.5 percent in 1978) on natural gas as a fuel source. In fact, Boston Gas currently has a moratorium on new service commitments. Proposals for new facilities to expand service are in preliminary stages. Currently, gas supplies for commercial and industrial developments in Boston are uncertain. Boston Gas is dependent on LNG from Algeria, a source of questionable stability. Even brief interruptions of Algerian LNG, such as the weather-delayed shipments in 1981, would contribute to local shortages of gas. In the event of a domestic gas shortage, the Federal Energy Regulatory Commission would curtail supplies to commercial and industrial customers before depriving higher priority residential and

institutional customers. Regardless, even if natural gas continues to cost less than other fuels, natural gas customers will pay much more than they do currently.[12]

Boston Gas expects to expand its supplies and serve more customers in the next few years.[13] However, uncertainties in availability and price of natural gas give Boston Gas an unpredictable role as an energy source for new development in Boston.

ENERGY EFFICIENT SITE AND BUILDING DESIGN

The most promising mechanism for the City to promote energy efficiency is through controls on the siting and design of buildings. As noted in the section on wind, shadow, and noise; the development impacts affect the microclimate in localized areas which in turn, affects energy consumption. Site and building design can minimize the undesirable impacts on the micro-climate, take advantage of the site's desirable characteristics, and thus limit the amount of fossil fuel-derived energy required. Careful controls of building mass, configuration, orientation, fenestration, exterior wall design and materials, and color can make a difference in the City's total fuel consumption.

Choosing the proper controls to achieve optimal energy savings requires careful analysis of specific projects. In many cases, trade-offs amongst the array of design opportunities is required. For example, if the windward side of a proposed building is also the building's southern exposure, then the objective of maximizing solar gain (through placement of windows on the southern side) would conflict with the goal of minimizing conductance losses (through placement of windows away from strong winds). Within a framework of general rules, there needs to be flexibility for achieving the optimal savings for each redevelopment.

General rules can be applied to the process of designing a building for Boston's climate and energy system. The following sections outline some possibilities and important considerations for site layout and building design.

Building Orientation

Building orientation significantly affects energy requirements. The path of the sun, the directions of local wind patterns, and the positions of other structures are of particular concern and should be considered carefully in light of projected building uses.

Boston, in comparison to many other American cities, can benefit from the solar energy available. With thoughtful site planning and building design, solar energy can substantially reduce Boston's fossil fuel dependence. To do so, new construction should optimize solar exposure (shade in summer and gain in winter) minimize wind turbulence, especially at the street level; minimize exposure to prevailing winds; and minimize adverse shadow and wind impacts on neighboring parcels.

Building Massing

To reduce the amount of energy lost through conductance, the most efficient building shape is a cube. Relative to building volume, this shape has a minimum of exposed surface through which unwanted heat loss or gain could occur.

Tall buildings are subject to significant internal drafts; consume substantial amounts of energy because elevators can account for as much as seven percent of the total consumption; and create wind turbulence which affects neighboring buildings.

The creation of internal drafts, known as the chimney effect or stack induction action, can disrupt internal climate and reduce the efficiency of air conditioning. Drafts down stairwells and shafts can suck conditioned air out of working areas, creating the need for more heat or air conditioning. Wind turbulence created by tall buildings can increase energy consumption in neighboring buildings because the turbulence heightens thermal losses. Because of these potential impacts, buildings should be massed to minimize the amount of exposed building surface, internal draft effects, and external wind turbulence.

Landscaping

That Boston is one of the windiest cities in the country poses problems for energy-conscious builders. High winds generate a greater demand for energy. For example, a house of conventional construction has 2.5 times the heating load in a nineteen mile per hour wind as in a three mile per hour wind at the same temperature. Wind analysis and landscape planning can reduce building energy consumption, while increasing the comfort of pedestrians and inhabitants.

Shading can reduce surface temperatures of sunny surfaces by twenty to thirty degrees Fahrenheit. Similarly, ambient air temperatures over paved surfaces can be higher than those over planted areas by as much as thirty-five degrees during summer months. Therefore, reducing ambient air temperatures around buildings can lead to significant reductions in the cooling load.

This can be achieved by landscaping sites so that as much of the site's paved surfaces and the building surfaces as possible are shaded by deciduous trees; as much of the site as possible is planted with grass, particularly immediately around buildings; and evergreen windbreaks are placed on the north and west sides of buildings at appropriate distances.

Life-Cycle Costing

Life cycle costing (LCC) may be the single most effective device available for insuring both energy savings and optimal capital allocation. Many private engineering and architectural firms now utilize computerized LCC programs to determine which available technologies will give developers maximum energy savings over their period of ownership for the least first cost. In addition, a number of Federal agencies have adopted the methodology and procedures for LCC analysis developed by the Department of Energy and the National Bureau of Standards.[14,15]

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LCC is familiar to private, revenue-generating projects under the designations "capital budgeting," value engineering," "value analysis," and "cost benefit analysis." This costing method allows the computation of total cost of ownership over the expected life span of an asset; incorporating initial cost, predictable operating and maintenance costs, ultimate disposal value, and quantifiable benefits to the owner. In many instances, operating and maintenance costs over the long life of a building far exceed initial costs (Figure VIII-2). It may be more desirable to pay a higher initial cost to obtain lower total ownership costs in many cases.[16]

By evaluating a range of energy system and design alternatives, LCC could help identify options which will both reduce life cycle costs to the benefit of the City and be affordable to the developer. (See Figure VIII-3 for several analysis options and their most frequent applications.)

ENERGY SYSTEM TECHNOLOGIES

Though not all energy systems are cost-effective for all locations, some systems can perform well in Boston and reduce the City's total consumption of fossil fuels. Unlike oil, many alternative energy sources, such as heat pumps with performance coefficients greater than three, geopumps, and windmills deliver more useable energy than they consume. The following section describes alternatives to Boston's current energy sources.

Solar Power

Active systems are being installed in large numbers throughout New England, principally for residential hot water. There also are a growing number of commercial, institutional, and industrial systems being installed for process needs. Passive systems, on the other hand, are generally an integral part of a structure's basic design rather than an added on feature. Passive solar designs for all building uses are becoming less expensive, reliable, aesthetic, and comfortable means of meeting space heat and daylighting demand.

Wind Power

Although the presence of high annual average wind speeds makes the generation of electric power from wind electric conversion systems feasible in certain locations in Boston, implementing such systems is complicated. Once adequate site-specific windspeed tests have been conducted, the potential user must negotiate with the electric utility company and with community groups which might oppose the project. The Boston Zoning Code, however, presently exempts windmills from height limits.

Cogeneration

The simultaneous generation of useful heat and electric energy is commonly referred to as cogeneration. Cogenerators are designed to produce either electricity or heat primarily. In the former case, an engine turns an electric generator while waste heat from the engine is captured to heat rooms and water. In the latter case, boilers produce steam which typically performs process or heating functions before turning an electricity generating turbine. The advantage to these systems is that the operator is making productive use of what, for a traditional boiler system, is waste heat. The best of these

systems delivers 850 useful Btus for each one thousand Btus of fuel put into it. This is compared to 330 useful Btus of electricity delivered for each one thousand Btus of fuel burned in the electric utility's boilers.

Cogenerators can be sized small enough to meet the needs of just one or two houses or large enough to serve millions of square feet of institutional demand. Unless a unit is large enough to emit one hundred tons per year of a regulated pollutant, it will not be subject to air pollution regulations. Noise, however, may be an issue. The Massachusetts Department of Public Utilities regulates arrangements between cogenerators and other small power producers, and the utility companies.

District Heating

Frequently a companion to cogeneration, district heating provides space heat and hot water to many buildings. Boston currently has a district heating system Downtown, owned and operated by Boston Edison Company. However, it is old and expensive to operate. District heating sales are not regulated by the Massachusetts Department of Public Utilities, the City of Boston, or any other public agency. Boston Edison does not hold an exclusive franchise in Boston. Certain neighborhoods or development areas of Boston are more appropriate than others for district heating. Areas, such as Fort Point Channel, with extensive and diverse energy demands, are necessary to justify the capital costs of a district hearing system.

Heat Pumps

Heat pumps are an old technology receiving renewed attention. They are devices which "pump" a heat-carrying medium through a heat exchanger. Generally, they are reversible and can heat in winter and cool in summer. The old-fashioned window air conditioner is a one-way heat pump which uses freon as the medium and copper fins as the heat exchanger. New versions of the heat pump use water, air, and other media to carry heat, and they use the air, ground water, a body of water, or the earth as sources of heat or as heat sinks (places to dump heat in the summer).

There are several advantages to heat pumps. First, they are efficient and consume little fuel to operate. Their coefficients of performance (CoP) are usually well above one, usually between two and three and sometimes as high as fifteen, as compared with an electric resistance heating unit with a CoP of one. Second, they are even more economical when used in conjunction with a thermal storage system whereby the storage medium can be heated or cooled at night when the demand for and cost of electricity are less. The stored energy can then heat or cool the building the following day when costs and demand are higher.

In Boston heat pumps would perform well if located near the Harbor, the Charles River, or the Back Bay where the water table is high, since ground-water or a large body of water can be used as both a heat source and sink.

CONCLUSION

While the City cannot control all the factors affecting energy supply and demand, it can promote energy efficiency through development guidelines. Site and building design controls could reduce energy consumption. The City could also promote the use of alternative energy systems, protecting solar access in appropriate locations and promoting systems appropriate for specific areas.

NOTES

1. Energy Profiles of the Municipalities in Suffolk County, Xenergy, Inc., Burlington, MA (May, 1981). This study was performed under a contract with the Suffolk County Extention Service as part of their Project for Reliable and Affordable Energy. Because this contract amount was so small, the data generated is necessarily rough. It is, however, the total energy end use data available for Boston. It is used here merely to provide a sense of the magnitude of the economic implications of Boston's energy use patterns.

2. Fortune Magazine, "Facility Location Decisions," (New York; September 1977), p. 31. Fortune surveyed one hundred U.S. firms on the comparative importance of factors in locating their next mainland U.S. plant. Data was derived from plans for expansion through 1986.

3. Connelly, J., Lewis Cohen, and Robert Persons, Energy Efficiency through Site and Neighborhood Design: A Report to the Boston Redevelopment Authority, The MITRE Corporation (Bedford, MA: July, 1981), pp. 1-3.

4. Energy Profiles of the Municipalities in Suffolk County, Xenergy, Inc., Burlington, MA (May, 1981). Most of the information contained in the Consumption section is derived from this study.

5. It is assumed there will be a short-term shift of indeterminate scale away from oil-fired boilers toward gas-fired boilers and electric heat pumps based on current prices.

6. Residential space conditioning will be affected primarily by the retrofit efforts of individual homeowners and landlords. Building department records reveal that fewer than a dozen applications are filed annually for new single family residential construction. Multifamily buildings do, generally, fall within the jurisdiction of the BRA's design review powers and will be affected by BRA policy. Most single-family new construction, however, does not. This sector and retrofit efforts are, thus, outside of the scope of this publication.

7. NEPLAN, NEPOOL Forecast for New England: 1981 - 1996, New England Power Pool (West Springfield, MA: April, 1981). Additional data obtained from the Boston Edison Company Rates and Research Department, June, 1981.

8. Connelly, J., Lewis Cohen, and Robert Persons, Energy Efficiency through Site and Neighborhood Design: A Report to the Boston Redevelopment Authority, The MITRE Corporation (Bedford, MA: July, 1981), p. 391 et seq.

9. Joint Long-Range Forecast of Boston Gas Company and Massachusetts LNG, Inc. (Filed with Massachusetts Energy Facilities Siting Council, April 15, 1981), Table G-23.

10. Ibid, Table G-5. The split-season is April 1st through March 31st.

11. Historically, natural gas suppliers in southern regions of the U.S. have given priority to intrastate markets. Because interstate gas prices have been controlled by the Federal government, gas suppliers have sold gas for higher prices within their own states, and limited the amount of gas available for interstate markets. Boston's position near the end of major gas pipelines means that contracted supplies are limited and prices are higher than in locations closer to the gas-producing states.

12. The American Gas Association (Energy Analysis, November 1980) expected gas prices to increase 13.5 percent annually between 1980 and, 1990 based on an assumed inflation rate of 6.9 percent per year.

13. Boston Gas Forecast, op. cit. p.17.

14. Argonne National Laboratory, Community Systems: Energy Saving Programs for Communities (Argonne, IL: October, 1979). See, also, Calm, J., J. Roberts, and V. Rabl, Thermal Transmission Integrated Community Energy Systems, Argonne National Laboratory (Argonne, IL: December, 1980). Group Management Associates (for the U.S. Department of Housing and Development), MIUS and You -- The Developer Looks at a New Utility Concept: A Seminar Guide and Manual of Information, Encino, CA: 1979)

15. Federal Register, Vol. 45, No. 16 (23 January 1980) p. 5620 et seq. and Vol. 45, No. 209 (27 October 1980), p. 71326 et seq. (adds 10 CFR 436A). See also National Bureau of Standards, Life Cycle Costing Manual for the Federal Energy Management Program and General Services Administration, Life-Cycle Costing in the Public Buildings Service (July, 1977).

16. Brown, Robert J. and Rudolf R. Yanuck, Life Cycle Costing: A Practical Guide for Energy Managers. (Atlanta, GA: 1980.)

17. Anything which converts sunlight into useful energy is a solar collector. At the simplest level, a window, which merely admits the light by which we read, is a solar collector. A masonry fireplace or body of water, which absorbs the warmth of the sunlight striking it during the day and releases it during the evening, is another kind of solar collector. Specifically, these typify passive solar technology, which, by definition, requires no electric or mechanical assistance to do the job. Passive solar principles have been understood and put to use for thousands of years, with superb examples having been found in the Assyrian, Egyptian, Greek, Roman, and, of course, American Indian cultures, among others.

    Active solar systems are those which require pumps and fans, etc. They generally employ flat plate collectors, mounted in arrays on roof-tops or the ground, and connected via ordinary ductwork or plumbing to

a storage and/or distribution system. The collection and distribution medium can be air, water, or a form of antifreeze or other specialized fluid.

18. The electric utility has a net efficiency of approximately .33. Therefore an electric resistance heater with a CoP of 1 has net efficiency, from primary fuel to end use, of .33. A CoP of at least 2 (net efficiency of .66) is necessary to compete with traditional boilers.

TRANSPORTATION

Efforts to improve travel in Boston by foot, car and mass transit focus on the following strategies:

- Reducing the numbers of vehicles entering Central Boston, particularly during peak hours;
- Avoiding conflicts between different transportation modes, notably the interruption of major pedestrian routes by vehicular flows;
- Separating through-trips from trips destined for Central Boston;
- Promoting the use of public transportation, bicycles, and carpools.

Strategies to mitigate congestion and environmental degradation should not inhibit access to Central Boston, discouraging future development. Rather, as more development takes place, strategies should maximize the ways in which new projects can improve the transportation system and minimize the adverse affects of urban growth. Development policy should consider the capacity of Boston's transportation: what are its limits, and can they be expanded without degrading the environment?

CURRENT STATUS AND ISSUES

The most recent extensive survey of automobile travel into the downtown area was taken in 1977 for the Central Artery Study. That study estimated that on an average weekday, there were 450,000 trips through the zone inside of Berkeley Street. Over one-third of the trips were destined for the Central Business District. During the peak morning hours, over 175,000 commuters enter the vicinity of Downtown. Nearly seventy percent of them ride the T; about thirty percent travel by automobile. Some commuters share rides. The average occupancy of the 39,000 cars entering the downtown area is 1.5 persons.

Even a decade ago, the highway system was operating at more than capacity during rush hours. Since then, traffic volume has grown by over one percent annually. The Massachusetts Department of Public Works estimates that it will continue to grow, at 0.5 percent annually, for the next twenty years.

To cope with traffic, commuters exercise several options. Some ride with others, some choose alternate routes, some travel before or after the peak rush hours. The more congested roads become, the more likely it is that commuters will alter their travel patterns. Some may even move closer to the city. Those for whom the trip is discretionary, such as shoppers, may forego it in favor of less-crowded alternatives. In the long term, congestion may lead to a locational shift of employment.

In Boston all these options have helped to accommodate traffic. The transportation system in Central Boston still functions reasonably well -- except during rush hours -- and efficient transit operations have scarcely been approached. Average car occupancy in the vicinity of downtown (1.4 persons) is far below capacity (about five persons per car).

Travel during peak commuting hours remains frustrating, irrespective of the mode of transportation. Downtown streets and arterials are crowded, as is mass transit. "Crush-loading" conditions lengthen the loading times for trains, slowing down the entire system. Buses and trolleys are slowed, as they compete with vehicular traffic on the streets. Although traffic will never flow as smoothly at rush hour as it does at less crowded times, conditions could improve with localized or large-scale modifications. Staggering work hours and increasing the number of car pools and the use of public transit could expand the capacity of the system, without dramatic changes to the transportation infrastructure. New development, though it generates additional traffic, often provides opportunities to improve the roadway system, because of demolition required for projects. Street realignment, changes in curb cuts, sidewalk widening, and street discontinuances are the types of improvements made possible by new development.

Large-scale changes to the transportation system are currently under study. The Third Harbor Crossing and depression of the Central Artery are two projects proposed to improve the most congested section of roadway in the metropolitan area. The Third Harbor Crossing project would divert traffic destined for Logan Airport and the North Shore from the Artery to a new tunnel. The project to depress the Artery proposes to increase that road's capacity by one-third in each direction, and it would improve access to the Artery by altering the ramps. Each project could alleviate traffic congestion in Central Boston by 1990, but should only be built if they will not adversely affect residential areas.

Parking Supply

There are an estimated 51,000 off-street parking spaces within Boston Proper, an area bordered by Massachusetts Avenue to the south and the water boundari in all other directions. Approximately 35,000 of these are open to the public; the remaining are spaces restricted for employees, guests, and residents.

The number of public spaces will change only slightly, as a result of the freeze on parking expansion. Some spaces were added recently, when formerly illegal on-street parking spaces were designated as legitimate, metered spaces. Changing the standards for parking spaces from twenty-three to twenty feet in length will increase the number of metered spaces within Boston Proper from 7,000 to 4,500. The number of private spaces may rise, as new projects include parking for employees. If the definition of "spaces" were to change in the freeze policy, private parking might be restricted as well.

Mass Transit

Systemwide, MBTA patronage has remained fairly constant since 1975, reversing the decline begun in the early fifties. Six-hour peak ridership into Central Boston is estimated at 365,000 trips. Rapid transit ridership accounts for the majority of the trips; express and local bus and commuter rail account for a lesser proportion of ridership. Private bus patronage has risen sharply over the last several years. The private bus share of the market should continue to expand as parking rates and the time it takes to drive to Central Boston rise. The opening of a bus terminal at South Station in 1985 will also boost private bus ridership.

Most transit lines operate at capacity during the peak hours. Capital improvements underway should improve current conditions and increase ridership. Projects include the extension of the Red Line to Alewife with a two thousand-car garage; Southwest Corridor's new construction between South Cove and Forest Hills; a new Back Bay station for commuter rail and rapid transit; the South Station Transportation Terminal for intercity buses, commuter rail, and rapid transit; platform extensions to accommodate longer trains at stations along the Orange and Red lines; and the rehabilitation of stations downtown.

Despite all the construction activity, funding for public transit, especially for operations, is diminishing. Lack of funds may reduce ridership. Because transit currently carries two-thirds of the commuter traffic, transportation and environmental policy on all levels is directed towards expanding the transit market share with whatever resources are available. Maintenance and improvement of the system is of utmost importance.

Truck Traffic

Trucks generate over five percent of all traffic in Central Boston and slightly more than that in off-peak hours. The shift from industrial to residential and office land use has reduced truck traffic Downtown. Now issues of concern are conflicts between pedestrian and automobile traffic, and trucks unloading on narrow streets. Controlling trucks which carry hazardous cargoes through Central Boston is a serious safety issue.

Pedestrians

Pedestrian volumes in the Central Boston have been growing over the last several years. The Downtown Crossing pedestrian surveys noted entering daytime volumes to be 74,000 in 1978, rising to over 82,000 in 1980.

Pedestrian-oriented settings, such as Quincy Market and Downtown Crossing, account for some of the growth. People living in the inner city neighborhoods -- Beacon Hill, Back Bay, the North End and Waterfront, and Charlestown -- and walking to work Downtown also have increased the volume of foot-traffic.

REGULATORY CONTROLS, POLICIES, AND STRATEGIES

The Boston area has led the nation in development of innovative transportation policy. The landmark Boston Transportation Planning Review (BTPR), created in 1970, was established to re-evaluate existing plans and policies and to provide the basis for a regional transportation program. The principal policy determination made as a result of BTPR, was that no new expressways within Route 128 would be built. BTPR determined that new expressways would only further burden the congested roads feeding into the expressways, exacerbate parking problems, reduce mass transit's ridership, degrade the environment, and disrupt neighborhoods. Because additional expressways would create negative impacts, BTPR wrote policies to encourage alternative improvements to the transportation system. The policies, reinforced by Federal and State policies and programs, emphasize regional transit improvements, discourage highway expansion, and limit traffic entering downtown by restricting parking.

The basic objectives of the City's transportation policies for Central Boston are to:

- o reduce the number of vehicles entering Downtown, particularly during peak hours;
- o promote the use of public transportation, bicycles, and higher-occupancy vehicles;
- o avoid conflicts between different transportation modes; and
- o separate through trips from trips destined for Downtown.

The City attempts to achieve these objectives in part through the BRA's review of development proposals. In its review, the BRA evaluates a proposal's potential impact on the following: traffic and circulation, parking; transit, goods movement, pedestrian movement.

Traffic and Circulation

Traffic policies are intended to manage and attempt to limit vehicular congestion. To do this, the City acts to mitigate adverse effects of traffic added by new development with signalization, parking enforcement, resident parking programs, street or intersection realignment, and circulation changes. The City attempts to steer the location of developments expected to generate large numbers of people, to areas with direct transit and/or expressway access as much as possible. Implementation of programs such as staggered working hours, four-day work weeks, car and vanpools would reduce peak-hour demands on the system.

Because transportation is a regional system, policy extends beyond the local level; Federal, State, and regional agencies also shape Boston's transportation system. The Federal government funds transportation expenditures in the region; the Metropolitan Planning Organization (MPO) controls the Federal funds. MPO is comprised of representatives from the Commonwealth's Executive Office of Transportation and the Department of Public Works, and representatives from regional bodies -- Massachusetts Bay Transit Authority (MBTA), MBTA Advisory Board, Metropolitan Area Planning Council, and Massport. Although the City is not a signatory to MPO, it is involved in the regional transportation planning process through its membership on the Joint Regional Transportation Committee (JRTC), an advisory organization to the MPO, and through its prominent position on the MBTA Advisory Board.

The Urban Mass Transportation Administration (UMTA) evaluates transit proposals and has spent hundreds of millions of dollars on the MBTA system over the past decade to expand service and stem the decline in transit usage. UMTA has also provided the impetus for an auto-restricted zone demonstration project -- the Downtown Crossing.

The Federal government also exercises control over local transit through its regulatory powers. The Environmental Protection Agency's (EPA) air quality standard, require a reduction in automobile travel in Boston's core.

Responsibility for various programs and for operating key links in the transportation system falls to state and regional entities. The MBTA's operating decisions -- frequency of service, cutbacks, and station closings -- as well as its programs to stimulate ridership, affect commuter traffic in Boston. Massport sets toll rates for the Mystic River Bridge and operates port facilities and Logan Airport. The Sumner and Callahan Tunnels, along with the Turnpike, are operated by the Massachusetts Turnpike Authority. The Commonwealth operates Masspool, a program to encourage the use of van and car pools.

Within the City government, downtown transportation policy making is shared. The BRA and the Department of Traffic and Parking share general planning and design responsibilities. The Departments of Police, Fire, and Public Works all set policies to pertinent to each department's particular transportation and jurisdictional requirements. In addition, a transportation policy advisor serves on the Mayor's staff. The Public Improvement Commission (PIC) holds final approval authority over proposals to change public rights-of-way. PIC is comprised of the City Commissioners of Traffic and Parking, Public Works, Water and Sewer, Building and Real Property.

Reviewing proposals which affect the transportation system is also shared. Prior to plan submission at PIC, projects are customarily subject to staff review and discussion by the Traffic Liaison Committee, composed of senior staff from Traffic and Parking, BRA Transportation Planning, Fire Department, Public Works, and the Water and Sewer Commission.

Most transportation planning, as noted above, is carried out in accordance with policy, rather than regulations. The City, however, does regulate parking and loading -- two aspects of the system which affect new development.

Parking

Off-street parking in the Central Boston is regulated through two mechanisms: the zoning code administered by the BRA staff for the Board of Appeal and the parking freeze, administered by the Boston Air Pollution Control Commission. The coordinated parking policy pursued by these regulatory bodies is to restrict the amount of parking spaces within the core area, thereby discouraging the use of private cars for downtown travel and limiting the amount of Downtown land taken up by parking facilities.

Developers of new and rehabilitated residential structures and hotels are required to provide parking on the basis of the number of units and their location, varying 0.2 to from one space per unit. However, in some areas of Central Boston no parking is required by the zoning code. In practice, adequate parking for guests and patrons is demanded, and 0.4 spaces per unit is a recommended minimum level. Parking may be provided off-site; leasing of nearby spaces is permitted in some instances, with the approval of the Zoning Board of Appeal.

In the past, office developers were required to provide a certain number of parking spaces per square footage. Under the current zoning code, parking is now a conditional use in a so-called Restricted Parking District, and

approval for any non-residential parking facility within the district (shown in Figure 4) must be granted by the Zoning Board of Appeal. To gain approval, one of the following conditions must be evident: that the facility is needed; that it consolidates or eliminates existing facilities; that it does not contribute to peak period traffic; or that it is a temporary use of the land. Making its decision on the Zoning Board of Appeal considers the advise of the BRA.

EPA regulations prohibit on-street parking in Central Boston during peak morning hours. The City implements this regulation by posting signs in areas where parking is not allowed before 9:30 a.m. Meters and residential stickers are also used to reduce all-day on-street parking, but illegal parking is prevalent nonetheless.

To meet the EPA's air quality standards, a parking "freeze" in Central Boston was instituted in 1975. The freeze set stipulated a ceiling on the number of commercial parking spaces within the district shown in Figure VIII-4, limiting the number of spaces (35,503) to those in existence on October 15, 1973. To modify or construct new commercial parking facilities in this area, parking operators must have a Parking Freeze Permit, issued only if an equivalent number of off-street or legal on-street parking spaces have been eliminated within the freeze area. The freeze applies only to spaces open to the general public where cars are parked for a fee. If the general public is excluded from a facility, for example in resident, guest, or employee-only parking, an exemption from the freeze can be obtained. The Boston Air Pollution Control Commission is the issuing agency for these permits and exemptions. It determines need and conformance with City policy.

The parking freeze was implemented to discourage automobile access to and in Downtown, to reduce vehicle miles traveled in the region, and to encourage greater use of public transit. The parking freeze is consistent with policies of maximizing pedestrian and mass transit use in Downtown, and utilizing prime real estate for office, commercial, residential and cultural uses, rather than for automobile parking.

Sufficient parking for retail customers is an important component of attracting business to the Downtown. For this reason, short-term parking for shoppers and visitors is favored over all-day commuter parking. The City, however, has little influence on the rates charged by private parking facilities.

Off-Street Loading

Trucks and delivery vehicles are necessary in the Downtown, but on-street deliveries and trucks backing into loading bays impede traffic flow and are hazardous to pedestrians. Under the Zoning Code, off-street loading facilities are required for buildings. The purpose of this regulation is to insure that loading activities do not interfere with traffic or pedestrian flows. The number and length of loading bays required varies with the square footage and the type of building.

Policies relating to the movement of goods include:

- o designating truck routes where necessary to remove heavy through traffic from residential streets;

- o locating loading docks so there is minimal interference with traffic and pedestrians;

- o restricting deliveries in Downtown Crossing to early morning hours.

Mass Transit

The success of existing policies limiting automobile access in Central Boston relies on an efficient transit system. Hence, the City and the MBTA must cooperatively implement transit policy. The following transit policies, applied to recent development projects, were stated in the BTPR report:

- o Transit stations should be integrated into the design of new projects wherever possible.

- o Major development should occur in the vicinity of transit terminals and stations wherever possible.

- o Pedestrian connections between transit stations and should be facilitated through station design, use of escalators, plazas, etc. The design of stations and street level development should facilitate pedestrian connections between the two.

- o Employers should encourage transit use by offering MBTA passes, staggering work hours, or through similar incentives.

- o Development policies should encourage pedestrian and mass transit activity, and discourage vehicular traffic.

- o Fares should be set at a level that encourages the use of public transportation.

Pedestrians

Boston's narrow streets and sidewalks impede walking, and pedestrians struggle with traffic and loading zones, in addition to the occasionally inhospitable climate. To make pedestrian travels more pleasant, the City encourages development of pedestrian-oriented facilities, such as those found at Quincy Market and Downtown Crossing. There, as elsewhere in Central Boston, the City promotes the following policies:

- o Avoiding conflicts between modes of travel, through the use of crosswalks, signals, and traffic restrictions.

- o Providing a pleasant, comfortable, and safe environment by putting in place weather protection, lighting, wide sidewalks, unobstructed walkways, street furniture and landscaping.

- o Orienting ground-level retail uses to pedestrians, with open doorways and display windows.

- o Restricting curb-cuts for driveways, parking lots, or loading zones on sidewalks heavily used by pedestrians.

Providing an alternative for commuters, water-based transportation could help to alleviate congestion and to conserve energy. Some vessels already transport commuters from _____, to Downtown, but docking facilities are currently inadequate. If redevelopment along the waterfront were to include and improve docking facilities, ferries could serve as a major source of transportation linking Downtown with East Boston and Logan Airport, residential and commercial areas of South Boston, and outlying communities.

Environmental Review

New development may create adverse traffic impacts. Although major development proposals are subject to environmental review, the cumulative impacts of projects on transportation systems are not evaluate. Because of the number of large projects planned and under construction in Central Boston, the environmental review process should include an overall analytical framework, capable of assessing the total impact of incremental additions to the City's physical inventory.

NOTES

1. The Commonwealth of Massachusetts Execution Office of Transportation and Construction, and Department of Public Works, "Boston Central Artery: 1977 Origin Destination Study", November 1978.

WATER SUPPLY

Fresh water is supplied to metropolitan Boston by the Metropolitan District Commission (MDC), principally through the Quabbin, Ware, and Wachusett Reservoirs in the central part of Massachusetts. These sources provide the potable water supply, as well as water for fire fighting, industrial, and recreational uses. The current regional demand from the forty-four communities served by the MDC system is over 315 million gallons per day (mgd), and Boston uses more water than any member in the system. Boston currently draws an average of 140 mgd, slightly less than its estimated safe yield of 141.7 mgd. Industrial uses in the City account for approximately 12.42 mgd or nine percent. Boston Edison consumes the most water (approximately 2.8 mgd), and Gillette, the second largest industrial consumer, uses 1.4 mgd (1975).

Although Boston's demand for water does not exceed its safe yield now, the City's water usage is expected to average 153 mgd, with occasional demands for 161 mgd, by 1990. Regionally, the current demand already exceeds the safe yield by fifteen mgd. With the per capita demand growing annually, MDC predicts a shortfall of seventy mgd systemwide by 1990.

Several factors account for the supply system's inadequate capacity. Although Massachusetts is a relatively humid state with an average annual rainfall of forty-three inches, periodic droughts have occurred every six to ten years recently. Consequently, reservoisr are dangerously low. The stress on the system is compounded by filling and construction in wetlands areas that feed into the storage system. There is also a growing demand from non-MDC member communities to enter the system, as town reservoirs and wells become depleted or contaminated by toxic waste.

Any new large development or cumulative small developments will place further demands on the overburdened water supply system. If current use and climate trends continue, serious water shortages will occur before 1990, even without new consumers.

The MDC is currently working toward increasing the capacity of the system. However, it will require at least five years to bring one new reservoir on line. This first additional source, now under consideration by the MDC, would increase the safe yield of the system only enough to meet the current demand. An additional five years will be required to further supplement the system to meet the 1990 projected demand. At the present time there are no definitive data on the demand or supply of water beyond the 1990s. However, the MDC is developing reliable projections of demand for the year 2020 and is studying methods of both increasing the safe yield of the system and minimizing the demand for water.

REGULATORY CONTROLS, POLICIES, AND STRATEGIES

The authority to improve the water supply system and to minimize additional demands on it is shared amongst State, regional and local agencies: Massachusetts Department of Environmental Quality Engineering (DEQE), MDC,

and the Boston Sewer and Water Commission (BWSC). The State also attempts to control additional demand through its building codes, the City through its development review procedures. Each of these entities can play a role in promoting water conservation, an important strategy for managing the future water supply.

The 1977 Massachusetts Water Supply Study estimated that water consumption could be reduced by fifteen to twenty percent over ten years through a program of public education, plumbing code revisions, price structure, and public ordinances. The success of water conservation programs in other areas of the country has ranged from a sixty percent reduction reported by Marin County, California during the drought of 1976-1977, to Denver's variable success with a nine to eleven percent reduction, to conservation programs with no measurable success.

BWSC, which manages the distribution and service of the water supply within the City, has the authority to employ several strategies to promote conservation. It sets user prices, subject to MDC approval. In as much as price can govern demand, price-setting can serve as one conservation-promoting tool. BWSC may also institute other conservation measures of its own design or those initiated by MDC. For instance, several major sources of unrecorded water usage include leaky water mains, meter slippage, unmetered use, and hydrant use. A primary measure now being implemented by BWSC attempts to eliminate one of these sources; the leakage detection and repair program has saved approximately fifteen mgd in the past few years.

MDC is currently determining future water needs and methods of improving supply, as is outlined in the Commission's preliminary report -- Phase I of the Northfield Water Supply Project EIR. In addition to its planning function, MDC also initiates and implements conservation measures. One method employed by MDC is to set appropriate rates for industries discharging effuents into the MDC sewer system, thereby encouraging conservation and recycling by large industrial users.

The State can influence water consumption through DEQE, which has the authority to institute emergency bans on water usage, and through State building codes. In 1978 the Massachusetts Plumbing Code (248 CMR: Board of State Examiners of Plumbers and Gas Fitters) was changed to require low flow showerheads (three gallons per minute maximum) in new construction and renovations. The low flow showerheads could reduce individual household consumption of water by twelve percent. Legislation also was offered in 1979 by the Special Legislative Commission on Water Supply to limit toilets in new and renovated construction to those using 3.5 gallons/flush.

Local governments have several options for promoting conservation that are unavailable to the State and MDC. The City can allocate water to different users within the municipality, and it can enact ordinances related to water conservation.

Through the authority of BWSC, the impacts of new development on the water supply system can be mitigated. The BWSC recently has required all new construction which would use over ten thousand gpd of water and is within

the over-capacitated East Side Interceptor drainage area, to install holding tanks to retain waste water until off-peak use hours of the sewerage system. Fifty-three State Street, the Waterfront Hotel, and Devonshire Towers are subject to that regulation. The BWSC also has the authority to deny a sewer hook-up permit if no modifications can be made to accommodate sewer capacity. Therefore, although the inadequate water supply is not grounds for prohibiting development, the BWSC could do so on the basis of inadequate sewer capacity.

SEWERAGE SYSTEM

Boston's sewerage system is approaching its centennial. Built in 1884, the Boston Main Drainage System included twenty-five miles of main and intercepting sewer lines. As the City grew, additional lines were added to the system: the northern and southern Metropolitan Sewerage Systems were completed in 1904, and in 1967 the Boston Main Drainage System was connected to the northern Metropolitan Sewerage System.

The Main Drainage System now includes the Boston Main Interceptor, the West Side Interceptor, the East Side Interceptor, and several smaller interceptors which flow into the Main Interceptor. The System carries combined sanitary sewerage and storm drainage from the City and adjacent towns which have connected to these systems to accommodate commercial and residential development.

Because of its age, major portions of the system -- especially the East Side Interceptor (Figure VIII_5) and Deer and Nut Islands sewerage treatment facilities -- are inadequate to accommodate the volume of flow during peak demand periods. When the hydraulic capacity of the mains is insufficient to handle the volume, combined storm water and raw sewerage discharges directly to Boston Inner Harbor and Charles River Basin. Combined sewer overflows (CSO's) are the central cause of pollution in the Harbor and Basin and occur in dry weather, as well as in rainy periods. Dry weather overflows contribute approximately fifty percent of the pollution entering the Inner Harbor through the combined sewer system (The Water Quality section describes CSO pollution in more detail).

Inefficient treatment facilities create other problems. The average daily flow to Deer Island is 310 mgd. The design capacity of Deer Island is 343 mgd, with a peak capacity of 848 mgd. While the design capacity is not yet exceeded, the peak capacity can be surpassed during periods of moderate rain, as well as during periods of excess demand. The Nut Island primary treatment facility has a design capacity of 112 mgd which has been exceeded for several years.

Primary treatment -- screening, sedimentation, and skimming -- removes virtually all settleable solids and a portion of other pollutants, including toxic metals bound to suspended solids and nutrients which create a high biological oxygen demand. The effluent or liquid by-product of the process is chlorinated to kill bacteria and is then discharged into the Harbor. The sludge or solid by-product is further treated to reduce organic solids and then discharged into the Harbor. Although the sludge and effluent have undergone treatment, they still pollute.

Disposal of the sludge from Deer and Nut Islands has caused oozy sediments containing heavy metals to accumulate on the floor of Boston Harbor, and has contributed to the contamination of shellfish.

Leakage from old lines is another major problem with the sewer system. The leaks allow infiltration of fresh and seawater in both the local and interceptor sewers and thus exacerbate the CSO's and demand for treatment by increasing volume. Development Downtown could increase the burden on the sewerage

system and detract from the water quality of Boston Harbor and the Charles River Basin, unless steps are taken to improve the system and conserve water. Already several programs are planned and underway to upgrade the capacity and efficiency of the system, as described below. However, there is a strong need for concurrent water conservation measures in the City to reduce input to the system.

REGULATORY CONTROLS, POLICIES AND STRATEGIES

The requirements of the Federal Clean Water Act of 1972 (P.L. 92-500) and Massachusetts Water Quality Standards have prompted the Metropolitan District Commission (MDC) and the Boston Water and Sewer Commission (BWSC) to upgrade the sewer system.

Federal P.L. 92-500 mandates eliminating the discharge of pollutants into the navigable waters by 1985 and stipulates that sewerage treatment plant effluents receive a minimum of secondary treatment. Based on engineering studies indicating the benign effect of effluents discharged from Deer and Nut Islands (which receive only primary treatment), the MDC applied to EPA in 1978 and 1979 for a waiver of the secondary treatment requirement. During this period, EPA published the draft and final Environmental Impact Statements on Facilities Planning for the MDC system, in which EPA recommended incineration of sludge from the entire MDC sewerage district at Deer Island. State, regional, and local environmental agencies opposed incineration, and a statement to that effect was developed by Boston Harbor Interagency Coordinating Committee (BHICC). BHICC includes EPA, the Department of Environmental Quality Engineering, the MDC, and the BWSC.

The Secretary of the Massachusetts Executive Office of Environmental Affairs also issued a statement that the FEIS did not adequately comply with the requirements of the Massachusetts Environmental Policy Act due to insufficient information on incineration and sludge composing alternatives. At the present time, these waste treatment issues are unresolved.

The MDC is currently undertaking the following major projects to meet the goals of Federal and State legislation:

- o pre-treatment for removal of toxic industrial wastes;
- o replacement of the Boston Main Interceptor and East Side Interceptor sewers;
- o control and treatment of combined sewer overflows;
- o upgrading of the treatment facilities at Deer Island and Nut Island;
- o management of primary sewage sludge from Nut Island and Deer Island.

Construction of the Charles River Estuary Pollution Control Facility was completed in 1980. This facility treats CSOs which enter the Basin from Boston, Cambridge, and Somerville. Planning for CSO control in the Inner Harbor has begun, and the MDC has recommended CSO control facilities at eleven other locations in the Inner Harbor, including Fort Point Channel.

The City and BWSC have also taken steps to improve the sewerage system. As part of its Urban Renewal program, in the late 1970s the City set up an extensive sewer separation program, supported by EPA funding. The BRA initiated design and construction of separation projects for the Charlestown, South End, South Cove, and Downtown Waterfront-Faneuil Hall Urban Renewal Projects. Work on the projects has continued through the coordinated efforts of the BRA and BWSC. The separation is nearly complete Downtown; but dry weather overflows, the remaining CSOs, and the insufficient capacity of the East Side Interceptor still cause water pollution.

The BWSC plans to increase the system's capacity by replacing the East Side Interceptor, but design and construction may take three to four years. To deal with the Interceptor's current inadequacies, the BWSC has recently required major new construction, such as Fifty-Three State Street, Devonshire Towers, and the Marriot Long Wharf Hotel, to install waste water holding tanks. The tanks retain sewerage during times of peak demand on the system and discharge it into the Interceptor during off-peak hours. If a development could not accommodate such a requirement, BWSC has the authority to deny the sewer hook-up permit, a prerequisite for a building permit. Figure VIII-6 outlines the area served by the East Side Interceptor where the inadequacy of the line would affect development. In general, any development within the East Side Interceptor drainage area that would produce over ten thousand gpd of waste water, would require a holding tank with a capacity for approximately sixty percent of the average annual flow.

The combined sewer overflow and the dry weather overflow controls, along with the replacement of the East Side Interceptor, should bring the quality of water in the Inner Harbor up to most of the Massachusetts Water Quality Standards. However, standards regulating dissolved oxygen will not be met because separated storm water runoff still carries a significant volume of pollutants including bacteria, heavy metals, and suspended solids.

ENVIRONMENT TABLES

BACKGROUND INFORMATION

Employment
Physical Inventory
Fiscal and Property Profile

BACKGROUND INFORMATION

INTRODUCTION

To expand on information provided in the chapters on commercial and institutional development and to provide a comprehensive view of the changes in each sector, this chapter describes the overall transformation of the economy and physical inventory of Central Boston. Development in Central Boston significantly affects the tax base city-wide, altering Boston's fiscal and property profile. Because of its importance in maintaining the fiscal health of Boston, this chapter also outlines changes in the fiscal and property profile and notes the impacts of tax exemptions, tax delinquency, and Chapter 121A agreements.

The following geographic areas are discussed in this section:

- Central Boston - the overall study area (Map ___),
- Downtown - the Central Business District and Back Bay (Map ___),
- Central Business District (CBD) - some areas of Downtown (Map ___).

ECONOMIC DEVELOPMENT

Transformation of the Boston Economy, 1950-1982

Boston's economy has undergone a fundamental structural transformation since 1950, as the service sectors have become more dominant than manufacturing and trade. Between 1960 and 1980, Boston lost 78,000 jobs in manufacturing and trade, but gained 100,000 jobs in the rapidly growing, broadly-defined service industries (Background Table 1).

Since 1975 however, manufacturing employment has become more stable and retail trade has increased. By 1982 employment in the City approached an all-time high, and the distribution of industries may lead to continued employment growth for the next decade. The Boston economy is now more diversified, less dependent upon the cyclically-sensitive manufacturing sector, and more closely in line with sectors of growth nationwide.

Downtown has played an important role in the City's economic transformation since its employment levels have grown steadily, even when employment lagged city-wide. In 1960 Downtown contained 237,000 jobs, approximately forty-five percent of all jobs in the City (Background Table 2). The number of jobs Downtown increased to 297,000, and Central Boston's share of employment grew to nearly fifty-five percent of the City's total employment.

Although retail trade rebounded and manufacturing stabilized, most employment gains resulted from growth in the service sectors. However, these sectors did not expand monolithically: virtually no growth occurred in public office employment, and rates of growth varied by office type (Background Table 3). The distribution of jobs generated between 1980 and 1982 is indicated below and described in more detail in Background Tables 4 and 5.

	Number	Percent
Professional/Technical	9,672	33.2%
Managerial	3,074	9.6
Clerical	11,577	36.2
Sales	1,577	4.9
Operatives/Laborers	6,103	19.1
	32,000	100.0%

This reshaping of the Central Boston economy to a regional service center enabled Central Boston to recover quickly from the serious national recession of 1974-1975. Employment levels for all major sectors of the downtown economic base have grown after the recessionary pause in 1975 (Background Table 6).

Boston's Labor Force

An occupational profile of the City's labor force shows the effects of the changing economy on the demand for labor. As a result of growth in the broad range of services and the increasing skill requirements of the modern economy, there are now many more white collar occupations -- professional, technical, managerial, clerical, and sales positions -- in the Boston economy than there were in 1950 (Background Tables 7, 8, and 9). Boston's resident workforce has adapted to this change by taking a greater share of professional, technical, and managerial position. Between 1970 and 1980, the percentage of Boston residents in such positions increased from twenty-two to thirty percent. Relative to white collar occupations, blue collar positions outside of the service sector have become scarce. The percentage of Boston residents holding such jobs has declined.

Along with the structural transformation and the increasing proportion of professional, technical, and clerical jobs (seventy-three percent of jobs created between 1975 and 1982 in Central Boston fall in these categories, as noted in Background Table 10), came changes in the composition of Boston's labor force. More women, minorities, and young people are now included.

Between 1970 and 1980, the percentage of all women working increased from forty-eight percent to fifty-four percent and included sixty-six percent of all women aged twenty-four to forty-four. Boston's total labor force, sixty-two percent of Bostonians older than fifteen years, is fifty-three percent male and forty-seven percent female. Fifteen percent of Boston's adult labor force is comprised of minority participants. Minorities have a lower labor force participation rate -- fifty-nine percent -- than all workers combined, but Boston's minority labor force share is triple the size of that for the whole metropolitan area. Also, compared to that of the metropolitan area, the City's labor force continues to have a higher concentration of workers in the sixteen to twenty-four age group. Boston's female labor force participation rate is greater than that for the nation (fifty-four to fifty-one percent) while its minority rate is lower (fifty-nine to sixty-two percent). (See Background Table 11.)

Resident Employment

From 1975 through 1982, development in Central Boston created nearly 18,000 of the 50,000 city-wide total number of new jobs for Boston residents (Background Table 12). This translates into a thirty-six percent rate of resident job capture.

The resident capture rate varies amongst the commercial and institutional sectors. Although office industries have the smallest resident job capture rate (thirty percent), extensive office development created the most job opportunities for Boston residents of any economic sector in Central Boston (Background Tables 13 and 14).

Expanding medical institutions created over 2,400 new permanent jobs for Boston residents, the second largest number of jobs resulting from Central Boston's development. Growth of educational, cultural, and other institutions added another seven hundred new resident jobs over the five-year period. Institutions hire residents for forty percent of all jobs, approximately the same rate as the average for all Boston jobs.

The remaining sectors of economic development fostered the growth of nearly two thousand jobs for Boston residents. Retail, hotel, manufacturing, and government industries all hire an above average share of Boston residents, but limited development activity in this period held down the total number of resident jobs created. Two large manufacturing expansions in Central Boston, those of Teradyne and New England Nuclear, resulted in over 150 resident job opportunities, sixty-three percent of all new manufacturing jobs.

Two categories dominate the profile of Boston resident occupations (Background Table 15). Professional/technical occupations totalled 6,783, or thirty-eight percent of all new resident jobs, probably because of growth in office industries and medical and educational institutions. The 6,314 new clerical jobs represented thirty-five percent of all resident jobs. Over 3,125 service and blue-collar resident jobs were created by new development, a seventeen percent share of total employment. The total occupational mix of resident jobs created was weighted toward white-collar positions.

Resident jobs created by development in Central Boston between 1975 and 1982 have benefited the City's economy. Boston's resident labor force unemployment rate fell from 12.8 percent in 1975 to 6.1 percent in 1980. During the 1980-1982 recession when nationally the unemployment rate rose to 9.7 percent, Boston's rate averaged only 8.3 percent. The addition of eighteen thousand jobs for residents contributed to the lower rate. The resident job rate, however, has fallen from thirty-nine percent in 1970 to thirty-five percent. Metropolitan area residents have captured 32,000 of new jobs; their employment contributes to the regional strength of Boston's economy (Background Tables 15 and 16).

Overall, opportunities for Boston's labor market have improved with diversification of the City's economic base. Total employment of 540,000 workers comes close to matching the 1968 peak level, rising from its lowest level in 1975. Although some problems persist, the City's labor force is adjusting to structural changes in the economy, and recent signs of continued economic growth are providing further means for adjustment.

Projected Employment Growth

According to economic projections, the number of people employed in Boston may reach 630,000 by 1990. Currently two-thirds of the jobs in the City are located in Central Boston. As 83,000 new jobs are created in the 1980s,

Central Boston is likely to support two-thirds of those positions as well. Growth in the service sector's employment will continue as a major force in the local economy, and in Central Boston particularly, the potential exists for moderate gains in construction, manufacturing, and trade, as indicated by local and national economic factors (Background Table 17).

Sources used to project economic growth and development activity include the Bureau of Labor Statistics (BLS) long-range forecast of output and employment for U.S. industries and the Massachusetts Division of Employment Security's (MDES) State-wide forecast. The BLS' model of national economic trends includes labor force characteristics, labor productivity, government revenue and expenditure policies, changes in consumer preferences, competition from foreign products, and changes in business purchasing and investment patterns. Selecting from BLS' and MDES' data those growth rates which approximate Boston's economic characteristics (i.e., industry mix, recent growth trends, constraints and stimulants to the local economy), it is possible to forecast 1990 employment levels for the City and for each of its economic development sectors (Background Tables 17 and 18). The projections measure growth potential and are not meant to serve as rigid targets or predictions. In the chapters on commercial and institutional development, these employment projections are examined together with other indicators of growth and demand for each economic development sectors in Central Boston. This affords a view of the long-range economic potential for each sector and of the match between short-term economic potential and actual development activity.

Development Activity

Approximately fourteen million square feet of new and seven million square feet of rehabilitated commercial, mixed-use, and institutional space was developed in Central Boston from 1975 through 1982 (Background Table 19). Development activity diminished towards the end of the decade but has increased in recent years.

Most development activity and employment gains occurred in the office and institutional sectors. (Background Table 20 shows the distribution of floor area amongst non-residential uses.) Between 1975 and 1982, 8.5 million square feet of new office space was built in Central Boston. The 5.2 million square feet of new space constructed in 1975 represented the end of the previous building boom. After 1975 the average net annual increase in office stock was 500,000 square feet while absorption (the amount of additional space occupied) averaged over 900,000 square feet per year. This mismatch reduced office vacancy rates from a peak of fifteen percent in 1977, to two percent in 1981, and contributed to rising rents for Class A office space. Office space shortages encouraged the growth of rehabilitation and conversion projects, which became increasingly popular after 1976. Downtown, the center for new construction, was also the location of renovation, such as those made to Quincy Market and Downtown Crossing. Back Bay buildings provided opportunities for numerous, small renovations.

Medical and educational institutions have been expanded, adding over three million square feet in Central Boston. Most projects were newly constructed or were additions to existing buildings. However, cultural institutions sought to improve their space by rehabilitating small theaters, tourist, and recrea-

tional facilities. The Federal Reserve Bank was the only public office building constructed between 1975 and 1982, though several schools and public facilities underwent renovation. Retail development occurred at a moderate pace between 1975 and 1982; 1.2 million square feet was developed, mostly through renovations to existing structures. However, there was little net increase in retail space, due to several losses Downtown.

Reversing a long-term trend, manufacturing experienced a modest upswing in Central Boston with the completion of two major manufacturing projects: Teradyne in the Leather District and New England Nuclear in the South End. According to market surveys, there was also growing interest by manufacturers to locate in Central Boston, close to its work force and transportation network. To accommodate new firms and assist older firms displaced by "higher uses", EDIC/Boston has renovated the old Boston Army Base, described in the chapter on manufacturing.

Urban development, since 1975, has altered the skyline of Central Boston and the streetscape Downtown. Fourteen major new office and institutional structures, all of them more than thirty stories in height and all with a floor area ratio (FAR) in excess of ten, have been built since 1975.

According to Boston Landmarks Commission records, seventy-five structures listed on or eligible for the National Register of Historic Places underwent significant rehabilitation between 1975 and 1982. Many other buildings of architectural merit also benefited from major rehabilitation. Some historic buildings, including sixteen structures on or eligible for the National Register and a number of buildings of lesser architectural importance were demolished to make way for new structures (Background Table 21).

Appendix Table B provides a complete listing of major projects completed between 1975 and 1982. The chapters on commercial and residential sectors describe proposed changes to Boston's physical inventory.

FISCAL AND PROPERTY PROFILE

The following fiscal and property profile describes Central Boston's role in the City's economic and tax bases up to FY1983's property tax equalization. When the results of equalization are available, they will substantially redefine the tax base. FY1981 records, essentially unchanged in FY1982, are summarized in this section and document land use patterns and the property tax base structure as they appear prior to tax equalization.

Present Composition

City records for FY1981 indicate that Central Boston contains slightly more than ten percent of the City's land area of taxable and exempt property parcels. (See the Ward Boundary Map and Background Table 22), yet Central Boston includes nearly half the property tax base. It contains almost three-quarters of the commercial tax base, two-thirds of the residential/commercial tax base, and about one-half of industrial-assessed values. The nearly 4,500 single-family homes (including condominiums) in Central Boston constitute more than thirteen percent of the City's single-family dwellings (Background Table 23).

Within Central Boston, taxable commercial and industrial uses each occupy about one-fourth of taxable land area or one-tenth of total area. Vacant land and apartments each cover around fourteen percent of taxable or 5.6 percent of total area. Sixty percent of Central Boston's tax base is in commercial property. Another 12.6 percent of the area's tax base is industrial (Background Table 24).

Central Boston sub-areas support a variety of land uses. Half of Charlestown's taxable area and assessments are industrial. Ward Three's tax base is nearly eighty percent commercial, in contrast to Central Boston and Boston as a whole, where commercial properties account for one-half and one-quarter, respectively, of the total tax bases in these two areas. Commercial properties cover well over half of the ward's taxable land area, over a fourth of total area. The part of South Boston within the study area boundaries is largely industrial. Land in the Back Back, Beacon Hill, Fenway, and South End has a concentration of apartment buildings. That part of the South End near City Hospital (in Boston's Ward 8) has nearly thirty-five percent of taxable and thirteen percent of total land standing vacant. Changes in Central Boston's taxable properties between 1975 and 1980 are listed by ward in Appendix D.

Fiscal Soundness

Central Boston's half of the City's tax base shows greater fiscal soundness than that of the rest of the City, as evidenced by tax delinquency records. Approximately fourteen percent of the area's taxable properties are in tax title process, the same percentage seen city-wide, but the monetary extent of delinquency in the rest of the City is nearly three times as great. Almost half of Central Boston's delinquent taxes are due from Ward 3, but measured against the more than half of Central Boston's tax base found here, this section shows considerable fiscal strength. The lower South End is heavily encumbered by unpaid back taxes, with around half of the properties owing a total about equal to last year's tax bill for the entire sector. This first approximation may be overly pessimistic, however, if the problem in Wards 8 and 9 is concentrated south of Central Boston boundaries (Background Table 25).

Tax Exemption

Exempt properties cover around sixty percent of land in Central Boston. This exceeds the approximately fifty percent city-wide average. Some of this land, however, is occupied by revenue-producing 121A developments. Excluding these, the exempt percentages of area are about fifty-five percent and fifty percent respectively for Central Boston and the City in 1980. While Central Boston holds fourteen percent of the City's total exempt land area, it contains about thirty-eight percent of Boston's exempt 121A land. Nearly a third of Central Boston's total exempt land is in Charlestown.

Trends: 1975-1980

Official City records[2] show an 8,550,747 square foot or 11.1 percent increase in tax-exempt area for Central Boston between 1975 and 1980 (Background Table 26).[3] However, discrepancies exist within the data available so the following provides a more meaningful measure of the growth of tax-exempt

uses in Central Boston: about fifty-five percent in 1973 and sixty percent in 1980 was classified as exempt land. Keeping in mind the inexact nature of the data, it is still worth noting that about three-quarters of the reported gain in Central Boston's exempt area took place in Charlestown. The reported percentage gain of 11.1 percent in Central Boston far exceed the 3.9 percent increase for tax-exempt land city-wide.

Assessed values of taxable properties in Central Boston increased by over seventy-six million dollars, or 10.5 percent between 1975 and 1980. This occurred despite the loss of about 9.5 million dollars in FY1977 as Jordan Marsh was granted 121A status. Much of this growth resulted from the 1980 initial phase-in of tax equalization. During the same five-year period, total assessments in the rest of the City rose by only 1.3 percent. Within Central Boston, the greatest percentage increases occurred in single-family homes, two-family homes, mixed residential/commercial properties, and industrial realty. Decline in the tax base of apartment properties were offset by increases in the number of one-family homes as apartments were converted to condominiums. The number of taxable apartment properties fell by 206, and the number of single-family homes grew by 1,696 between 1975 and 1980 (Background Table 27).

Central Boston's tax base growth has been neither steady nor monolithic between 1975 and 1980. Between 1975 and 1979, realty assessments declined 3.2 percent in Central Boston and 3.6 percent for the entire City. The FY1981 reassessment program increased Central Boston's tax base by 14.2 percent in one year, as part of a city-wide 9.5 percent increase. The significant growth of Central Boston's tax base between FY1976 and FY1981 resulted from additions and deletions to the taxable roll, value-raising conversions (particularly to condominium dwellings), and different levels of change among old and new existing properties. The most notable deletion was the granting of 121A exemption to Jordan Marsh's $9.5 million of assessed property value.

Additions include the nearly 15.5 million dollars increase over twenty-five million dollars for the Hancock Tower, over $6 million added to One Federal Street's assessment, nearly 2.5 million dollars added at 50 Staniford Street, over twelve million dollars at 60 State Street, and almost five million dollars at the Federal Reserve Bank. These additions comprise 5.7 percent of Central Boston's FY1976 tax base. Existing commercial properties have also contributed to recent assessment growth. Background Table 28 profiles the tax history of twelve major new office buildings. Total assessments for these rose from 67.5 million dollars in FY1976, to 71.2 million dollars in FY1980, and 83.4 million dollars in FY1981. A survey of thirteen randomly selected, older Class C office buildings shows an aggregate assessment drop of four percent from 5.9 million dollars in FY1976 to 5.7 million dollars in FY1980, followed by an eleven percent jump to 6.3 million dollars in FY1981. The end result is a 7.1 percent rise between 1975 and 1980. Taken together, these factors are the principal reasons for Central Boston's tax base growth.

Total assessed values in Central Boston and the City remained constant in FY1982, the year preceding general reevaluation, despite major growth and development.

Fiscal Impact of Development

The role of development in strengthening the City's tax base and expanding revenues from payment in-lieu of tax agreements can be seen in Background Table 28, a summary of Appendix A. Two hundred and seven developments completed between 1975-1981 represent nearly 2.2 billion dollars of realty investment, 1.7 billion dollars of which was spent in Central Boston.

Developments accounting for half the realty investment now contribute to the tax base; those accounting for one-third of that investment contribute to the City through 121A agreements on payments in-lieu of taxes; those accounting for one-sixth of that investment have no formal payment mechanism.

121A Developments

About thirty-eight percent of the land area and eighty$_4$ percent of the assessed value of Boston's 121A projects are in Central Boston. Fully forty-five percent of the City's 121A assessed value is within Central Boston's Ward Four.

One hundred and fourteen 121A projects were approved between 1961 and the end of 1981, excluding takeovers and dissolutions. Of thirteen approved in 1979, only two (Servicenter and the Long Wharf Hotel) contained no residential use. Three of these thirteen contained some commercial use. Of fourteen approved in 1980, only one (1000 Washington Street or Teradyne) was not exclusively residential. All six 1981 approvals were for residential development.

Between 1975 and 1981, sixty-nine 121As were approved, representing over one billion dollars of development in 1981 constant dollars. Seventy percent of these projects are for residential development. Background Table 29 summarizes this activity and illustrates the trend towards increasing concentrations of 121As in the residential sector. One reason for commercial developers' willingness to proceed without 121A tax protection may be seen in their taxes. Taxes as a percentage of rents are declining for commercial property. Assuming average rents of nine dollars per square foot in 1975 and seventeen dollars per square foot in 1980, taxes as a percent of gross rents for these twelve office buildings declined from twenty-two percent in 1975 to twenty percent in 1980, despite assessment and tax rate increases. Assessing practice and legal abatement standards have offered taxes at or below the level of payments called for by current 121A guidelines.

The role of 121A in fostering development may be seen in Appendix I. Here recent developments are characterized by tax status, and the importance of 121As in Boston's residential construction and rehabilitation is clear. Nine out of ten new and rehabilitated dwelling units completed in Boston during 1980 were covered by 121A. Appendix E lists all projects with 121A status.

While comprehensive figures on current 121A revenues are not now available, Background Table 30 shows that, for four of 1980s residential 121A developments for which negotiated 6A payments have been estimated, new revenues in-lieu of tax will substantially exceed previous tax bills.

NOTES

1. The land area of Central Boston -- 141, 727, 227 square feet in all -- includes 55,943,662 square feet of taxable area; 6,699,268 square feet occupied by 121A developments; and 79,084,297 square feet in other tax-exempt uses. All figures on areas, properties, and tax base are first approximations based on the rough correspondence between City Ward and Central Boston boundaries. These figures are not exact.

2. Assessing Department Annual Recapitulations of Taxable and Exempt Property, FY1976 and FY1981. Figures abstracted for Central Boston are approximations.

3. These same records show only a 2,616,774 square foot loss of taxable area (Table 51). This discrepancy, part of a reported city-wide gain of eighteen million square feet of total area in this period, cannot be easily resolved.

4. This approximation abstracted from FY81 special recapitulation of exempt property (City Assessing Department).

BACKGROUND TABLES

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